MORPHOLOGY AND TAXONOMY OF THE ADULT MALES OF THE FAMILIES PSEUDOCOCCIDAE AND ERIOCOCCIDAE (HOMOPTERA : COCCOIDEA)

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By S. A. AFIFI*

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SYNOPSIS

The adult males of 17 pseudococcid species (belonging to 13 genera, and represented by macropterous and apterous forms) and 7 eriococcid species (belonging to 4 genera, and represented by macropterous, brachypterous and apterous forms) were described and illustrated in detail. The study indicated that the two groups, whose taxonomic status was yet controversial, deserved the rank of separate families, and the characters differentiating the males of the two families were given. The general morphology of the males was discussed and a number of new terms introduced. The affinities of the studied species (and 3 others described in detail by Giliomee, 1961) were determined and statistically analysed, and a classification of Pseudococcidae was suggested. The relationships of the lecanoid types of male (Pseudococcidae, Eriococcidae and Coccidae), between each other and with other families of Coccoidea were discussed. The results of this work confirmed earlier conclusions by Ghauri (1962) and Giliomee (1961 & 1967) that the males afford significant characters at all the taxonomic levels including the specific. Detailed keys to the families downwards to the species were constructed.

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INTRODUCTION

This work is the fourth in a series of detailed morphological and taxonomical studies on the males of Coccoidea (Theron, 1958, studied the general morphology of 7 species representing 4 families ; Ghauri, 1962, described in detail 24 species of the family Diaspididae ; Giliomee, 1967, similarly treated 23 species of the family Coccidae) carried out by the postgraduate students in the Department of Zoology and Applied Entomology, Imperial College, suggested and supervised by Dr. K. Boratynski. The present publication deals with 24 species belonging to two groups, the pseudococcids (17 species) and the eriococcids (7 species), whose taxonomic status is still controversial ; they have been considered as (1) merely tribes of one subfamily, Pseudococcidae (Cockerell, 1899 ; Balachowsky, 1948) ; (2) subfamilies of one family (Balachowsky, 1942 ; Borchsenius, 1949), or (3) separate families, with rather remote connection between them (Ferris, 1937, 1957 ; Borchsenius, 1963). Apart from the grouping of certain pseudococcid genera by some authors (the *Rhizoecus* group including 8 genera by Hambleton, 1946, and the tribe Planococcini by Ezzat & McConnel, 1956), no comprehensive classification of the pseudococcids or the eriococcids has been hitherto proposed. The purpose of the

present study therefore was (1) to carry out a detailed morphological study of the available male representative of the two groups ; (2) to evaluate the various characters for classificatory purposes ; (3) to determine the status and relationships of the two groups with each other and with other families of Coccoidea ; and (4) to suggest a classification for each of these groups.

REVIEW OF THE LITERATURE

The literature on the males of Coccoidea has been well covered by Ghauri (1962) and Giliomee (1967) ; therefore only the papers either omitted by these authors, or published subsequent to their works, will be discussed here.

One of the early papers not mentioned by them is Comstock's (1881) First Report on Scale Insects, in which the main features of the males of a number of species of the subfamilies Diaspinae (=Diaspididae) and one eriococcid, *Rhizococcus araucariae* (Mask.) are briefly discussed. In many other early papers, however, the reference to the males are restricted to brief accounts mainly on the shape, size and colour of their bodies, or on the available puparia, apparently the empty ones (e.g. Rutherford, 1914 ; Brain, 1920 ; Hall, 1928 ; Takahashi, 1931). A paper by Kuwana (1923) (mentioned by neither Ghauri nor Giliomee) includes descriptions and illustrations of four scale insects, one mealybug, and one margaroid. MacDougall (1926) provided generalized descriptions of the males of *Pseudococcus comstocki* Kuwana. Rao (1943) drew attention to the existence of the apterous males of *Trionymus sacchari* Ckll. but made no description of any morphological importance. Beardsley published several papers dealing with a large number of pseudococcid males occurring in Hawaii (1960, 62, 63, 64 and 65) ; his illustrations of almost all the species only included ventral aspects of the penial sheath. In his paper of 1964 he suggested close relationship between *Phenacoleachia* and Pseudococcidae, which was also recognized by Giliomee (1967). In 1965, Beardsley showed that the males of *Antonina crawii* Ckll., unlike their counterpart females, do not exhibit features departing from the usual pseudococcid male type. Dziedzicka (1961), while studying the developmental stages of *Gossyparia spuria* (Modeer), described two forms of the adult males (the brachypterous and the macropterous) ; her descriptions are concise and her interpretation of the abdominal segments is inaccurate. Lellakova-Duskova (1965) briefly described the different male stages of *Quadraspidiotus marani* Zahradnik, including the adult. Jakubski (1965) provided short accounts on the available males of the family Margarodidae. Pesson & Bielenin (1966) redescribed the males of *Icerya corticalis* Vayssiere ; they sank it as a synonym of *I. maxima* Newstead, for which they erected the new genus *Gigantococcus*. Giliomee (1967) studied in great detail the males of 23 species of the family Coccidae ; he recorded few structures not previously observed, suggested a classification of the family based on the males, and discussed inter and intra-family relationships within Coccoidea.

MATERIAL, TECHNIQUE AND ILLUSTRATIONS

Material.

The males of 24 species, belonging to 17 genera and two coccid groups were

studied. The author came to the conclusion that these groups represent two closely related, though well separated families, Pseudococcidae and Eriococcidae. Most of the species were represented by the macropterous males only, but some were either brachypterous (*G. salicicola*) or apterous (*P. fraxini*) or with more than one form available (macropterous and apterous in *S. sacchari*, and macropterous and brachypterous in *G. spuria*). As already mentioned, comprehensive classification of the families Pseudococcidae and Eriococcidae does not exist ; thus, the species studied are given in the following list with those of Pseudococcidae arranged in groups suggested by the results of the present work.

PSEUDOCOCCIDAE

PLANOCOCCUS Group

Planococcus Ferris, 1950.
P. citri (Risso, 1813).
P. kenyae (Le Pelley, 1935).
P. dioscoreae Williams, 1960.

Planococcoides Ezzat & McConnell, 1956.
P. ireneus De Lotto, 1963.

Nipaecoccus Šulc, 1945.
N. vastator (Maskell, 1894).
N. nipae (Maskell, 1892).

Maconellicoccus Ezzat, 1958.
M. hirsutus (Green, 1908).

Ferrisiana Takahashi, 1929.
F. virgata (Cockerell, 1893).

Trionymus Berg, 1899.
T. newsteadi (Green, 1917).

PSEUDOCOCCUS Group

Pseudococcus Westwood, 1840.
P. obscurus (Essig, 1909).
P. citriculus Green, 1922.

Dysmicoccus Ferris, 1950.
D. alazon Williams, 1960.

SACCHARICOCCUS Group

Saccharicoccus Ferris, 1950.
S. sacchari (Cockerell, 1895).

OCTOCOCCUS Group

Octococcus Hall, 1939.
O. africanus (Brain, 1915).

CEROPUTO Group

Ceroputo Šulc, 1898.
C. pilosellae Šulc, 1898.

Centrococcus Borchsenius, 1948.
C. insolitus (Green, 1908).

NAIROBIA Group

Nairobia De Lotto, 1964.
N. bifrons De Lotto, 1964.

ERIOCOCCIDAE

Eriococcus Targioni-Tozzetti, 1868.
E. araucariae Maskell, 1879.
E. orariensis Hoy, 1954.
E. buxi (Fonscolombe, 1834).

Ovaticoccus Kloet, 1944.
O. agavium Douglas, 1888.

Gossyparia Signoret, 1875.
G. spuria (Modeer, 1778).
G. salicicola Borchsenius, 1949.

Pseudochermes Nitsche, 1895.
P. fraxini (Kaltenbach, 1860).

The material was secured from the following three sources :

Material received from other workers.

Specimens of most of the studied species were acquired through the kind co-operation of many workers from various parts of the world, at the request of Dr. K. Boratynski (see acknowledgements). Alcohol-preserved material of 15 species, slide preparations mounted in " Berlese fluid " of one species (*E. orariensis*), and dry material of another (*E. buxi*), were received. The " Berlese fluid " slides were soaked in warm water until the mountant was dissolved and the specimens released. The dry material was treated with 10% KOH for 24 hours, and the males were gently dissected from their puparia with a finely pointed quill.

Material collected in pupal stages.

The writer was able to collect and breed the prepupae and pupae of 10 species ; these were kept in glass tubes under laboratory conditions and produced adult

males. Of these, 5 were collected in England and 4 in Egypt, U.A.R. Among those collected in England were the males of *D. alazon*, whose pupae were accidentally found on a bunch of bananas, bought in a London fruit shop and imported from the Canary Islands. Two others (*Pseudococcus fragilis* and *P. adonidum*) presented the problem of correct identity, which frequently occurs in coccids ; they were found in a mixed colony, and since the identification still depends largely on the females, the actual copulation had to be observed as an evidence to identify the males. Descriptions of these two species are not given here, since they have already been treated in detail by Giliomee (1961) ; his data, however, were included in my tables and used in the discussion.

Material obtained from colonies.

Colonies of *Pseudococcus obscurus* and *Planococcus citri* on potatoes, and of *Chorizococcus lounsburyi* on potted bulbs (*Amaryllis* sp.) were bred in the laboratory.

It should be noticed that the results of Beardsley's studies (1960, '62, '63, '64, and '65), on a wide variety on pseudococcid species were also utilized, although not entered in the tables due to his different style of description.

Preparation and technique.

Theron (1958) introduced a method for mounting the coccid males, in which the specimens were stained by Chlorazol Black E (saturated solution in absolute methyl alcohol). His method was basically followed by Ghauri (1962) and Giliomee (1961 and 1967), and also here with slight modifications regarding the clearing (in KOH) and staining length of time. For details of the method adopted and illustration of the tools, see Afifi and Kosztarab (1967).

The data, in most species, were taken from 10 specimens each. The length of the thorax was taken from the postoccipital ridge to the posterior margin of the mesopostphragma. The length of the prescutum was topographically measured from its anterior margin to the prescutal suture ; the width of the prescutum, and also the lengths and widths of other structures (e.g. scutellum, basisternum) included the boundary ridges. The measurements of the leg segments were taken at their maximum ; the length of the tarsus only indicates the length of the distal tarsomere. The length of the abdomen was taken from the mesopostphragma to the anterior margin of the basal ridge of the penial sheath, or the antero-ventral margin of the genital capsule.

Part of the material of this study has been deposited in the collections of the British Museum (Nat. Hist.), London, and in the Department of Entomology, Ministry of Agriculture, Cairo, Egypt, U.A.R.

Illustrations.

The drawings were made to scale on graph paper, using a square graticule fitted into the microscope eye-piece. The front view of the head was particularly considered, to illustrate the relationship between all arms of the midcranial ridge.

In the general views of the body, the dorsal and the ventral arms of the midcranial ridge were drawn just outside the median line, so that the degree of their development could be shown.

GENERAL MORPHOLOGY

Newstead (1903) described, in general terms, the males of some species of the subfamily Dactylopinae (=Pseudococcidae and Eriococcidae), giving some particulars about the antennae, legs and the genital armature. Brain (1915) gave even shorter accounts of the males of some species of the subfamily Pseudococcinae. Makel (1942) was the first to carry out combined morphological and anatomical studies of 3 species of the genus *Pseudococcus*. Šulc (1943, 1944, 1945) gave comparatively detailed descriptions and illustrations of the males of *Phenacoccus aceris* Signoret, *Peukinococcus piceae* (Loew), and *Nipaecoccus nipae* (Mask.), respectively. Morrison (1945) described the macropterous males of *Heterococcus graminicola*, with generalized illustration of the body and more detailed drawings of antenna, hind leg, abdominal penultimate and genital segments. Reyne (1954) similarly treated the males of *Puto antennatus* Signoret, giving detailed accounts of the structure of the head and the genital segment ; he concluded that the males of *Puto* and *Macrocerococcus* are closely related, and included certain characters (e.g. number of eyes, structure of penis, number of caudal filaments) widely separating their type-species (*P. antennatus* Sign. and *M. superbus* Leon.) from that of *Phenacoccus* (*P. aceris* Sign., described by Šulc, 1943). He also supported the conception of Borchsenius (1948) regarding the re-establishment of the genus *Macrocerococcus*. Giliomee (1961) studied the males of *Pseudococcus fragilis* Brain, *P. adonidum* (Linn), and *P. maritimus* (Ehrhorn) comparatively ; he recognized two " types " of the last species, although later (1967) decided that these " types " represent two distinct species, as was confirmed by the present writer (see description of *Pseudococcus obscurus*).

In his excellent study on the subject, Theron (1958) recognized 10 general morphological characters identifying the lecanoid type of male, based on studies of two genera, *Eulecanium* (=*Parthenolecanium*–Coccidae) and *Pseudococcus* (=*Planococcus*–Pseudococcidae) ; he also indicated that the Pseudococcidae differ from Coccidae by more generalized condition of the genitalia (primitive character), the condition of the anterior tentorial arms and the ocular ridges (specialized characters). Giliomee (1961) found that two of Theron's generalized characters do not apply to Pseudococcidae and this was confirmed by the present study. Later, Giliomee (1967) discussed the relationships between the males of Pseudococcidae and Coccidae, listing 10 morphological characters (5 primitive and 5 specialized) separating the males of the two families. This again was confirmed by the present author.

It was here found that the pseudococcid and the eriococcid males differ by a number of morphological characters (listed later in the discussion), the importance of which is comparable with those separating Pseudococcidae and Coccidae. Therefore, it has been concluded that they deserve the status of separate families and will be here treated as such.

Derm Vestiture. The *body setae :* These are of two main types : The *fleshy* (Giliomee, 1961) or " digitiform " (Beardsley, 1960), which are comparatively thick and apically obtuse ; and the *hair-like* (Giliomee, l.c.) or " filamentous " (Beardsley, l.c.), which are much thinner, with very acute tips.

The fleshy setae may occur on any part of the body itself (i.e. on the head, thorax or abdomen), as well as on the antennae and legs (the *Pseudococcus* group), or their presence may be limited to the appendages only (most species of other groups), occurring both on the antennae and on the legs (*P. citri*), or on the antennae only (*N. vastator*) ; or are absent altogether (*C. pilosellae*). The hair-like setae always occur on the body and on the appendages. Other types of more specialized setae will be described later, together with the other details of the parts on which they occur.

The *disc pores.* With the exception of *Nairobia* group, the males of Pseudococcidae carry a number of disc pores, sometimes on the thorax and the abdomen only (e.g. *Octococcus* group), or also on the head (e.g. *Pseudococcus* group). In the material studied, the pores were usually quadrilocular, occasionally trilocular, quinquelocular or 6-locular ; in some species, Beardsley (1960) observed pores with more than 6 peripheral loculi.

MACROPTEROUS MALES

Head

The *head capsule* of the coccid male, as discussed by Theron (1958), is almost entirely made up of the epicranium ; the absence of the functional mouth parts has resulted in a considerable reduction of the " vorderkopf " and absence of the labium.

The head has the form of a somewhat irregular tetrahedron ; subtriangular in dorsal, lateral and frontal views ; broadest posteriorly across the genae, and becoming gradually narrower anteriorly towards the truncate apex and antero-ventrally towards the cone on which the ventral eyes are situated. Between the apex of the head and the ventral cone, the surface of the head is often depressed ; this *ventral preocular depression* (vprd) may be deep and conspicuous (e.g. *P. dioscoreae*), or shallow and ill-defined (e.g. *P. citri*) ; in the *Saccharicoccus* group, the depression is absent.

The head capsule is reinforced by a number of ridges, of variable shape, degree of development, sclerotization, etc. The *midcranial ridge* (mcr) with its longitudinal *dorsal* (dmcr), *ventral* (vmcr), and the apical transverse *lateral arms* (lmcr), gives support to the anterior part of the head. The dorsal arm is usually distinct although slender, but sometimes reduced and its position only marked by heavy sclerotization (*S. sacchari*), or absent altogether (*F. virgata*). This arm, when present, posteriorly reaches at least to the level of the dorsal eyes and then fades away (e.g. *P. citri*), or extends further back to meet or almost meet the postoccipital ridge (e.g. *P. obscuras*). Anteriorly, the dorsal arm is usually separated from the other arms by a very short distance. The ventral arm anteriorly gives off two branches, the lateral arms, forming a Y, or occasionally T-shaped ridge (*N. vastator*, Text-fig.

11B) at the apex of the head ; posteriorly, the ventral arm disappears before reaching the level of the ventral eyes. In *Ceroputo* and *Nairobia* groups, all arms of the midcranial ridge meet at the apex of the head, and a cruciform structure is formed (Text-figs. 33B, 35B, 37B). The lateral arms are usually well developed, but sometimes reduced (*N. nipae*). The *postoccipital ridge* (por) is slender and usually distinct although sometimes only marked by a sclerotized stripe (*C. pilosellae*) ; the ridge is U-shaped and medially continuous in almost all the species, but in *S. sacchari* it is V-shaped and medially interrupted. According to Makel (1942), the postoccipital ridge serves for the attachment of the cephalothoracic muscles. The area bounded posteriorly by this ridge is the *dorsomedial part of the epicranium* (dmep), which corresponds to the *median crest* in Diaspididae (Theron, 1958 and Ghauri, 1962) ; this area is slightly raised, well sclerotized, without polygonal reticulation.

The *preocular* (procr) and *postocular* (pocr) ridges were described as being fused below the lateral ocellus to form the characteristic Y-shaped structure on each side of the head (Theron, 1958 ; Giliomee, 1961), and this condition was considered by Theron as " a minor specialization " in Pseudococcidea. The present study showed that indeed this condition obtains in most species studied, but certain differences in details in a few of them, as well as the conditions described by Giliomee (1967) in some species of Coccidae, indicate that the interpretation of this " fusion " is rather inaccurate. Giliomee (l.c.) found, in *Eriopeltis* spp. for example, that the pre- and postocular ridges are connected just below the ocellus by a longitudinal *interocular* ridge (ior), giving support to the preocular ridge and its articulation with the antennae ; he suggested that this condition may be a forerunner of the situation in Pseudococcidae where the two ridges are fused. The present author found that most Pseudococcidae have the connecting interocular ridge well developed, and in some species (e.g. *P. citri*, Text-fig. 5 and *T. newsteadi*, Text-fig. 20) a short, though well marked lower part of the preocular ridge extends below the point of junction. It appears, therefore, that the Y-shaped ridge on the side of the head is a complex structure of : (1) the upper part of the preocular ridge, intimately fused with (2) the interocular ridge, which joins (3) the postocular ridge below the ocellus, with simultaneous more or less considerable reduction of the lower part of the preocular ridge. This condition, although reminiscent of that found in some species of Coccidae, is not necessarily evolved from it, but probably developed independently within Pseudococcidae and represents a specialization of this family. It also seems that this Y-shaped fusion of the ocular ridges serves to render support to the weakly-developed preocular ridge and its articulation with the antennae.

In *Ceroputo* and *Nairobia* groups the pre- and postocular ridges are well separated, but a longer (*C. pilosellae*, Text-fig. 34), or a shorter (*N. bifrons*, Text-fig. 38) rudiment of the connecting ridge is present, arising from the anterior edge of the postocular ridge just below the ocellus and extending anteriorly towards the preocular ridge. An aberrant condition was found in *C. insolitus* (Text-fig. 36), where a ridge anteriorly arising from the postocular ridge and directed towards

the preocular ridge is present but above the ocellus, thus it is not strictly homologous with the interocular ridge ; nevertheless, it probably serves the same purpose and may represent another independent morphological means to the same functional end.

The *ocular sclerites* (ocs) are weakly sclerotized plates on each side of the head ; rather large in *Ceroputo* and *Nairobia* groups (where the ocular ridges are separated), but are comparatively smaller and traversed on each side by the interocular ridge, in the remaining groups.

The *preoral ridge* (pror) is extremely slender and latero-posteriorly connected to both the postocular ridge and to the proepisternum + cervical sclerite, by means of a small triangular and weakly sclerotized plate.

Two pairs of *simple eyes* (accessory eyes, Berlese, 1893 ; ocelli, Green, 1922) surrounded by a narrow area of polygonal reticulation, and one pair of transparent lateral *ocelli* (o) (primary eyes, Krecker, 1909 ; rudimentary eyes, Green, 1922) are present in the species studied. Beardsley (1962) recorded 7 pairs of simple eyes and a pair of ocelli in one species, *Puto yuccae*, and the complete absence of the ocelli in another, *Rhizoecus falcifer*. The widely separated *dorsal eyes* (dse) are borne on the dorsal part of the ocular sclerites, between pre- and postocular ridges. The *ventral eyes* (vse) are much approximated and placed on the ventral protrusion of the head ; these, although usually somewhat larger than the dorsal eyes, are sometimes smaller (*N. vastator*), or both subequal (e.g. *C. pilosellae*). The ocelli are usually large and well developed ; in the *Planococcus*, *Pseudococcus*, *Saccharicoccus* and *Octococcus* groups the ocelli are situated at the base of the fork of the Y-shaped complex of ocular ridges, and are dorsally supported by a slender *ocellar ridge* (see lateral views) ; in *Ceroputo* group, where the Y-shaped complex is absent, they are supported by the postocular ridge and either a rudimentary sclerotized projection (Text-fig. 34), or a ridge-like arm (Text-fig. 36). In *Nairobia* group, the ocelli are vestigial and merely represented by atrophied spots.

The *genae* (g) are membranous, laterally bulging behind the postocular ridges and without any reticulation ; they form the latero-posterior margins of the head.

The *ventral cavity* (vc) is a longitudinal, narrow, slit-like invagination in the median line of the head. From the roof of this invagination arises the internal *cranial apophysis* (ca) which is always apically truncate ; according to Theron (1958), the cranial apophysis serves for the attachment of the antennal muscles.

The non-functional *mouth opening* (mo) is small, situated behind the preoral ridge. The " tendon-like apodeme " described in other families (Theron, l.c.) is absent in the species here studied. The *posterior tentorial pits* (ptp), from which the internal *posterior tentorial arms* (pta) originate, are minute and placed on the membrane on each side of the mouth opening. The posterior arms are connected with each other by means of the transverse slender *tentorial bridge* (tb). The *anterior tentorial arms* (ata) usually fuse just before meeting the cranial apophysis, but in *Ceroputo* and *Nairobia* groups they are well separated ; the *anterior tentorial pits*, therefore, are not visible externally.

The hair-like setae are always present on the head ; in the *Pseudococcus* group

the fleshy setae are also present. The head setae are generally arranged in the following groups :

(1) *The dorsal head setae* (dhs) : These occur anterior to the postoccipital ridge.

(2) *The genal setae* (gs), are present dorso-laterally on the genae ; sometimes there are 3 setae or less (e.g. *P. citri*), 7 or more (*Pseudoccus* group), or they occur in intermediate numbers (*T. newsteadi*).

(3) *The setae of the ocular sclerites* (ocse) : These are present in the *Pseudococcus* group only, and occur in two conditions relative to their topography : (a) the *dorsal ocular setae* (dos) occurring on the dorsal part of the ocular sclerites, were found only in one species, *D. alazon* ; and (b) the *ventral ocular setae* (vos), which occur on the ventral part of the ocular sclerites.

(4) *The ventral head setae* (vhs) are arranged in 3 distinct groups : (a) a group along the longitudinal median line between the ventral eyes ; these setae may be always present (*Planococcus*, *Pseudococcus* and *Saccharicoccus* groups), present or absent (*Nairobia* group), or entirely absent (*Octococcus* and *Ceroputo* groups) ; (b) a group forming a transverse band across the area of the ventral preocular depression, just anterior to the ventral eyes ; (c) a group of usually a few setae, arranged in a single line on each side of the ventral arm of the midcranial ridge.

One to three *dorsal head pores* (dhp) are usually present on each side of the midcranial ridge, near the base of the antennae (A and B in the figures), but in some species (*P. dioscoreae* and *S. sacchari*) 4 or more pores are present. In *Ceroputo* group, however, there is a *ventral pore* (vhp) occurring at least on one side of the head, and the dorsal pore may be absent (*C. pilosellae*, Text-fig. 33B), or also present (*C. insolitus*, Text-fig. 35B) ; in some other species (*F. virgata*) the head pores are absent altogether.

Antennae

The scape is inserted laterally at the anterior apex of the head and articulates with the antennal process of the preocular ridge ; the lateral arms of the midcranial ridge, when well developed, also extend towards the base of the scape but with which no articulation takes place. The antennae are typical filiform, normally 10-segmented, and vary considerably in length within the family ; in *Octococcus* and *Ceroputo* groups they are comparatively long (the body usually less than 1·6 times longer) ; in *Pseudococcus* and many species of *Planococcus* groups they are rather short (the body 1·6–2·5 times longer) ; in *Nairobia* and some species of *Planococcus* groups (*Nipaecoccus* spp.) the antennae are intermediate in length ; in *Saccharicoccus* group they are very short (the body more than 2·5 times longer). The flagellar segments of the pseudococcid males are cylindrical and usually conspicuously longer than wide.

The *scape* (scp) is the shortest and the widest (at the base) of the antennal segments. It becomes narrower distally, with the dorsal margin usually longer than the ventral ; the basal part is sclerotized and laterally articulates with the articular process of the preocular ridge. Distally, the scape articulates with the pedicel by means of a

process, into which the ventral sclerotization is produced. Usually 4 hair-like setae are present on the scape, but in *Pseudococcus*, *Saccharicoccus* and some species of *Planococcus* groups (e.g. *P. citri*), the scape carries more than 4 setae ; there are no other types of setae on the scape.

The *pedicel* (pdc) is narrow at the base and widest near the distal end, thus having a club-shaped appearance. At the base, the pedicel is ventrally supported by a ridge, which provides a minute process articulating with the scape. At the distal end of the pedicel, a narrow area of polygonal reticulation is present, where a small circular plate, presumably a *sensillum placodeum* (spl), is dorsally borne. The pedicel carries fleshy and hair-like setae.

The *flagellum* includes the intermediate (III to IX) and the terminal segments. The surface of these segments is somewhat irregular, and they are usually well separated, although partial fusion between two or more adjacent segments is frequent in some species (e.g. *P. ireneus*). Segment III is club-shaped, with a short constricted peduncle inserted into the pedicel ; this segment is usually the longest ; at least subequal in length to the terminal segment (*Saccharicoccus, Nairobia* and some species of *Planococcus* groups), or often up to 1½ times longer (*Pseudococcus, Octococcus* and other species of *Planococcus* groups), or even more (*Ceroputo* group). The width of the 3rd segment in relation to its length is also variable ; sometimes the length is 2–3·3 times the width (*Saccharicoccus* and many species of *Planococcus* groups, e.g. *P. ireneus* and *N. vastator*), 3·3–5·3 times (*Pseudococcus, Octococcus, Nairobia* and other species of *Planococcus* groups), or more than 5·3 times (*Ceroputo* group). Segments IV to X are relatively long in comparison to their width ; the terminal segment elongate, with a constricted, rounded or pointed apex.

Antennal setae : The following types of setae occur on the antennal segments :

(a) The *fleshy setae* (fs), usually present on segments II to X and represent the majority of the antennal setae, but sometimes the fleshy setae are entirely absent (*C. pilosellae*).

(b) The *hair-like setae* (hs), which always occur at least on the first three antennal segments.

(c) The *subapical sensory setae* (set. scla) are apically knobbed and occur on the terminal segment only, but sometimes are absent altogether (*Ceroputo* group).

(d) The *capitate sensory setae* (set. ca) : This group includes setae similar to the latter type but present on the antennal segments III to X ; these setae were found in *Octococcus* and *Nairobia* groups only.

(e) The *antennal bristles* (ab) are the stoutest bristle-like setae, usually longer than the fleshy setae and present on the last three terminal segments ; segments VIII and IX always with one ventral bristle, at about half the length of these segments. The terminal segment (Xth) with at least 3 such preapical bristles, one dorsal and one on each side ; in *Ceroputo* and some species of *Planococcus* groups (*N. vastator*), two additional and conspicuously smaller bristles are also present latero-ventrally, at a greater distance from the apex of the segment.

Thorax

Makel (1942) was the first to give adequate attention to the pleural region of the thorax ; Ezzat (1956) gave more detailed illustrations, but Theron's (1958) identification of the thoracic structures reached an incomparably higher standard.

Prothorax

The prothorax is distinctly separated from the head by the constricted neck ; in this respect, Pseudococcidae and Eriococcidae occupy an intermediate position between Diaspididae, where the neck region is not differentiated, and most Coccidae where the neck is very well pronounced. The pronotum is represented by the following structures : (1) the collar-like transverse *pronotal ridges* (prnr), which are medially interrupted and extend laterally on each side ; (2) two small *lateral pronotal sclerites* (prn), one on each side, anteriorly bounded by the pronotal ridge ; (3) a postero-dorsal pair of small sclerites, the *post-tergites* (pt).

The *proepisternum* is a distinct, triangular and well sclerotized pleural sclerite, on each side of the prothorax ; anteriorly it fuses with the rudiment of the cervical sclerite at a weak point to form one structure, the *proepisternum + cervical sclerite* (pepcv), which is dorsally approached near its anterior end by the pronotal ridge, and anteriorly articulates with the postocular ridge (see lateral views). Posteriorly, this sclerite (pepcv) is fused with a short *pleural ridge* (plr_1), which carries a small invaginated *pleural apophysis* (pla_1) ; the pleural ridge extends downwards and articulates with the basal process of the coxa. The proepimeron, which is usually apparent in certain families (Margarodidae and Diaspididae), is entirely indistinguishable in Pseudococcidae (and Eriococcidae).

The dorsal margin of the proepisternum is always heavily sclerotized and ridge-like ; in *Ceroputo* group, the ventral margin also is similarly sclerotized.

The *prosternum* (stn1) is reduced to a small and usually triangular plate ; in some species (*N. bifrons*) the plate is very short and wide, and in others (*T. newsteadi*) comparatively long and narrow ; in *C. insolitus* (Text-fig. 35) it is represented by two small separate plates. Posteriorly, the prosternum is usually bounded by a narrow transverse *prosternal ridge* (stnlr), which however is absent in *Saccharicoccus* group and replaced by heavier sclerotization of the posterior margin (Text-fig. 27) ; the median longitudinal ridge of the prosternum, which occurs in many members of the other families (Margarodidae, Coccidae and Diaspididae), is absent in Pseudococcidae (and Eriococcidae).

Dermal structures of the prothorax. The hair-like setae are always present on the prothorax ; in *Pseudococcus* group, the fleshy setae also occur. These setae are arranged in the following groups :

(1) The *medial pronotal setae* (mpns), which are present on the median and submedian areas between the pronotal ridge and the post-tergites ; 3 or more of these setae are usually present on each side of the median line (*P. citriculus*, Text-fig. 23), but in other species they are less than 3 (e.g. *P. citri*, Text-fig. 4), or absent altogether (*Octococcus*, *Ceroputo* and *Nairobia* groups).

(2) The *post-tergital setae* (pts) occur on, or immediately behind, the post-tergites ; this group is present in *F. virgata* among the *Planococcus* group, and in all species of the *Pseudococcus* and *Saccharicoccus* group, and may be also present in *Ceroputo* group.

(3) The *lateral pronotal setae* (lps) are situated on, or lateral to the lateral pronotal sclerites.

(4) The *antespiracular dorsal setae* (asds) occur laterally at about the level of the post-tergites ; 2–4 setae are usually present on each side, but in *Saccharicoccus* group there are 5 or more setae, and in *Octococcus* and *Ceroputo* groups they are usually absent.

(5) The *antespiracular ventral setae* (asvs) are present latero-ventrally, just behind the front coxa ; one seta almost always occurs on each side, but in *S. sacchari* two setae were found.

(6) The *prosternal setae* (stnIs) are present medially, on the prosternum or on the membranous part immediately anterior to it ; these setae may be less than 4 on each side (*Planococcus* and *Nairobia* groups), 4 or more (*Pseudococcus* group), or usually absent (*Octococcus* and *Ceroputo* groups).

The *disc pores*. In the groups of genera other than *Nairobia*, the disc pores are present, usually occurring in association with the prothoracic setae, and are arranged in the following groups : the *medial pronotal pores* (mpnp) ; the *post-tergital pores* (ptdp) ; the *lateral pronotal pores* (lpp) ; the *antespiracular dorsal pores* (asdp) ; and the *prosternal pores* (stnIp). The number of these pores is variable, but the post-tergital pores were found in *P. dioscoreae* only (Text-figs. 7, 8).

Mesothorax

The mesothorax is strongly developed. The shape and conditions of the sclerotized areas vary considerably within the family, providing a number of taxonomically important characters.

The *mesotergum* is divided into a mesonotum (or alinotum) and a mesopostnotum, which are widely separated by a large membranous area (postscutellum of Berlese, 1893) ; the mesonotum is further subdivided into the distinct prescutum, scutum and scutellum.

The *prescutum* (prsc), the antero-median area of the mesonotum, is dome-shaped ; in the dorsal view it is either transversely rectangular (*Planococcus, Pseudococcus, Saccharicoccus* and *Octococcus* groups), or triangular (*Ceruputo* and *Nairobia* groups). The anterior margin of the prescutum is invaginated, forming the *mesoprephragma* (phr_1) with its inner margin slightly notched in the middle. The prescutum is bounded laterally and posteriorly by the *prescutal ridges* (pscr) and the *prescutal suture* (pscs), respectively ; the suture is sometimes absent (*Saccharicoccus* group), or strongly developed, ridge-like and continuous with the prescutal ridges (*Ceroputo* group, Text-figs. 33 & 35).

The *scutum* (sct) is large, uniformly sclerotized throughout (*Ceroputo* and *Nairobia* groups), or with a median longitudinal narrow membranous area (the remaining

groups), and with the antero-lateral extensions surrounding the prescutum latero-posteriorly. These lateral extensions are produced into the *prealares* (pra), from which they are separated by the secondary *prealar ridges* (prar) ; the latter are anteriorly invaginated into small *finger-like apodemes* (a), and posteriorly support small *anterior notal wing processes* (anp). Each prealare is laterally differentiated into a strongly sclerotized *triangular plate* (tp) which forms the antero-dorsal boundary of the episternum ; this plate was called " prealar wing process " by Ezzat (1956). Behind the anterior notal wing processes, the postero-lateral extensions of the scutum are inflected downwards and then upwards to form the *posterior notal wing processes* (pnp) which are attached to the postalare.

The *scutellum* (scl) is pentagonal in dorsal view ; antero-laterally bounded by the *scutoscutellar suture* (scts), and posteriorly by *the inward fold of the posterior margin of the notum* (rd) ; the semi-cylindrical structure of the scutellum is due to deep inward inflection of its anterior and posterior margins ; these invaginated margins do not meet internally, thus the *scutellar foramen* which occurs in other families, e.g. Margarodidae, Diaspididae and Coccidae (Theron, 1958 ; Ghauri, 1962 and Giliomee, 1967) is absent in Pseudococcidae (and Eriococcidae).

The relative lengths and widths of the various mesonotal structures differ considerably within the family and the following ratios were found of taxonomic importance : length to width of prescutum ; length of prescutum to length of scutum ; length to width of scutellum ; length of scutellum to length of scutum.

The posteriormost part of the mesotergum, the mesopostnotum, is overlapped by the metanotum and thus externally invisible. This invaginated part constitutes the *mesopostphragma* (phr2) which is slightly larger than the mesoprephragma, and also has a small median notch. Laterally, the postnotum gives rise to a pair of strong finger-like *postnotal apophyses* (pna) within the mesothoracic cavity. Antero-lateral of the apophysis, the postnotum is produced into a *postalare* (pa) which reaches the pleural area and articulates with the pleural ridge of the meso-thorax. The postalare is reinforced by the distinctly separated *anterior* and *posterior postalar ridges* (apar & ppar) ; dorsally, it bears two small processes associated with the posterior margin of the wing and the posterior marginal fold of the notum, respectively.

The *mesopleuron* : The *mesopleural ridge* (plr2) posteriorly articulates with the base of the coxa, and extends antero-dorsally towards the base of the wing. At about half length, the ridge makes the characteristic sharp double bend and carries at this point the internal *mesopleural apophysis* (pla2) ; externally, this part of the ridge is overlapped by the postalare. The ridge is interrupted at a short distance above the coxal articulation ; this interruption was overlooked by Theron (1958) on describing *P. citri*, and according to Ghauri (1962) and Giliomee (1967) does not occur in Diaspididae and many Coccidae. The dorsal part of the (plr2) is relatively strong and terminates in a semi-circular *pleural wing process* (pwp2) ; the anterior margin of the latter is connected with the episternum by means of a ridge-like *basalare* (bas). Behind the pleural wing process, there is a small sclerite, the subalare (sa), whose articulation with the alary sclerites is rather obscure. The

subepisternal ridge (ser) articulates dorsally with the triangular plate and extends obliquely to approach the marginal ridge of the basisternum, thus bounding the *mesepisternum* (eps2) anteriorly. The mesepisternum is divided into a larger dorsal part, the supraepisternum or anepisternum, and the small ventral part, the infraepisternum or katepisternum (Snodgrass, 1935), both of which are separated by a membranous area. The katepisternum anteriorly fuses with the *lateropleurite* (lpl) which is attached to the lateral arms of the marginal ridge of the basisternum ; the lateropleurite is narrow (e.g. *Planococcus* group), but comparatively wide (e.g. *Nairobia* group). A small and well sclerotized *mesepimeron* (epm2) is present immediately behind the pleural ridge, just above its articulation with the coxa. A slender sclerite, presumably representing the *trochantin* (tn) occurs just anterior to the coxal articulation, and was found in all the species studied except *N. bifrons*. This sclerite was first described and illustrated by Giliomee (1961).

The *mesothoracic spiracle* (sp2) with its atrium and its supporting bar, the peritreme, is placed latero-ventrally anterior to the subepisternal ridge.

The *mesosternum* is represented by a large, slightly convex and hexagonal plate, the *basisternum* (stn2) ; this plate is framed antero-laterally and latero-posteriorly by the *marginal* and the *precoxal ridges* (mr & pcr2), respectively. In *Saccharicoccus* group the median part of the marginal ridge is completely absent (Text-figs. 27–30). The precoxal ridge posteriorly fades away before reaching the median line, where the posterior margin of the basisternum becomes slightly inflected to form a *furcal pit* (fp) from which the strong, two-armed *furca* (f) originates. The longitudinal median ridge of the basisternum, which occurs in many species of Margarodidae, Diaspididae and Coccidae (Theron, 1958 ; Ghauri, 1962 and Giliomee, 1967), is absent in Pseudococcidae (and Eriococcidae).

The *wing articulation* : The articular system of the fore wings is apparently the same in all the coccids, and only slight differences are shown in the size of the alar sclerites, the *pteralia*, which include : the *tegula* (teg), the *axillary* (first, second and third) (ax1, ax2 and ax3) and the *additional sclerites* (asc). The *costal complex of veins* (ccx) and the *axillary cord* (axc) give support to the anterior and posterior margins of the wings at their bases. Apart from these structures, the articulation also involves the anterior notal wing process, the pleural wing process, the basalare and probably the subalare.

The *dermal structures of the mesothorax* : The fleshy setae occur in the *Pseudococcus* group only, in the postmesostigmatal area, but the hair-like setae are always present, arranged in the following topographical groups : the *prescutal setae* (pscse) the *scutal setae* (sctse) ; the *scutellar setae* (scls) ; the *tegular setae* (tegs) ; the *postmesostigmatal setae* (pms) ; the *basisternal setae* (stn2s). The postmesostigmatal setae may be absent (*Nairobia* group) or present only laterally behind the mesothoracic spiracles (e.g. *P. kenyae*, Text-fig. 3), or also in the median and the submedian areas in a transverse band (e.g. *P. citriculus*, Text-fig. 23).

The numbers of the mesothoracic setae vary in the different species and constitute useful key characters.

With the exception of *Nairobia* group, the mesothorax usually carries a number

of disc pores, namely the *mesospiracular disc pores* (sp2p) and the median or submedian *postmesostigmatal pores* (pmp).

Metathorax

The metathorax is largely membranous and the metathoracic sclerites are considerably reduced, as a result of the modification of the hind pair of wings into hamulohalterae. The metanotum overlaps the inflected mesopostnotum and is indicated externally by a pair of small lateral *suspensorial sclerites* (ss), attached to the base of the hamulohalterae by means of a fine sclerotized tendon. The *metapostnotum* (pn3) is represented at the posterior extremity of the metathorax by small subtriangular sclerites, one on each side of the median line ; these sclerites are usually connected by a distinct transverse *metapostnotal ridge* (pn3r) (*Planococcus*, *Pseudococcus* and *Saccharicoccus* groups) ; this ridge is weakly developed in *Octococcus* and *Ceroputo* groups (Text-figs. 31–36), and entirely absent in *Nairobia* group (Text-fig. 37). The metapostnotal ridge, which is apparently absent in all other studied families, was overlooked by Theron (1958) and illustrated but not discussed by Giliomee (1961).

The *metapleuron* : The *metapleural ridge* (plr3) is well developed and articulates ventrally with the hind coxa ; as the ridge obliquely extends antero-dorsally, it attenuates near the middle where a small *metapleural apophysis* (pla3) is inwardly invaginated ; at the lower part, the ridge separates two irregular, sclerotized areas, the anterior *metepisternum* (eps3), and the posterior *metepimeron* (epm3) ; dorsally it supports a minute *metapleural wing* process (pwp3). The precoxal ridge of the metathorax (pcr3) originates below the episternum and extends ventro-medially ; this ridge, while being well developed in *Planococcus*, *Pseudococcus*, *Saccharicoccus* and *Octococcus* groups, is comparatively weak in *Ceroputo* and *Nairobia* groups. The *metathoracic spiracle* (sp3) is identical with that of the mesothorax, and lies ventro-laterally in the membrane anterior to the metepisternum.

The *metasternum* is represented by a pair of small submedian *metasternal apophyses* (sta) ; according to Ghauri (1962) and Giliomee (1967) these apophyses are absent in Diaspididae and Coccidae. The *metasternal plates* are absent in Pseudoccidae (and Eriococcidae).

The *dermal structures of the metathorax* : Fleshy setae occur in *Pseudococcus* group only, but the hair-like setae are present in all species. The metathoracic setae include the following groups : The *metatergal setae* (mts), anterior to the metapostnotal sclerites ; the *metapleural setae* (mps), just behind the metathoracic spiracles ; the *anterior metasternal setae* (amss), in the median and the submedian areas on the membrane between the basisternum and the metasternal apophyses ; the *postmetastigmatal setae* (eps3s), on the metepisternum along its antero-ventral margin, or just below it on the membranous area (this group of setae was found in *P. citriculus* only) ; and the *posterior metasternal setae* (pmss), medially on the metasternal membrane behind the metasternal apophyses.

The following groups of metathoracic derm pores, associated with the corresponding groups of setae, are also recognized : The *metatergal pores* (mtp) ; the

metaspiracular pores (sp3p) ; the *anterior metasternal pores* (amsp) ; and the *posterior metasternal pores* (pmsp).

Wings and Hamulohalterae

The fore wings are membranous, large and elongate, rounded distally and narrow basally ; the posterior margin of the wing is produced near its base to form a small *alar lobe* (al) which is adapted to receive the apically hooked seta of the hamulohaltera. The entire surface of the wing (except the area of the alar lobe) is evenly covered with minute hairs, the microtrichia. The venation is reduced to two veins, *radius* (rad) and *media* (med). Near their bases, the wings usually carry a variable number of *alar setae* (als), and a compact dorsal row of few *circular sensoria* (sens.), just anterior to the radial vein.

The metathoracic wings are modified into small and elongate *hamulohalterae* (h). This term (singular hamulohaltera), was recently proposed for the coccid males by Kawecki (1965) as a substitute to what was referred to as " pseudohalteres " in his earlier paper (1958b), or as " halteres " by other authors. On explaining the original definition of the word " haltere ", Kawecki showed how it could be applied correctly to the second pair of wings in Diptera and male Strepsiptera, but emphasized that their different appearance, structure and function in the males of Coccoidea demanded the adoption of another term. He also referred to the term " retinacoli ", used by earlier authors, maintaining that it is equally erroneous because it denotes an apparatus for fastening the wings, located on the anterior pair. The writer feels therefore that the proposed term seems to be more acceptable.

The hamulohaltera is membranous, supported along its anterior margin by a weak and slender *hamulohalteral ridge* (hr). This ridge was overlooked by many writers, but Jancke (1955) referred to a strengthening of the anterior margin of the hamulohaltera, and Giliomee (1967) described it as resembling a wing vein.

Legs

Three pairs of well developed legs, of variable lengths and stoutness, are present. The fore legs are usually the shortest and the hind legs the longest, but sometimes the middle legs are the shortest (*Ceroputo* group), or the fore and the middle legs subequal (e.g. *Nipaecoccus* spp.). The legs consist of the usual segments, all of which (except the claw) are beset with numerous hair-like, and usually fleshy setae also.

The *coxa* (cx) is supported at its broad base by a well developed ridge ; this ridge provides a small process dorsally, which articulates with the pleural ridge. The distal end of the coxa is narrower, and also supported by a ridge, which provides two processes, one on each side, serving for the articulation with the trochanter.

The *trochanter* (tr) with sclerotized basal and distal margins ; this segment is divided into a relatively long proximal part and a short distal one, by means of a distinct constriction supported by a weakly developed short ridge. One comparatively long hair-like *apical seta* (ase) may occur on the outer side of the distal part (e.g. *N. vastator*). Three *circular sensilla* are usually arranged in a triangle on each side, but in few individuals two or four on one side were observed.

The *femur* (fem) is relatively long and stout, broadest near the distal end, where a ridge with two processes is well developed.

The *tibia* (tib) is usually the longest segment of the leg, but in few species (*P. ireneus* and *S. sacchari*) the tibia of the fore leg is somewhat shorter than the femur ; at its base, the tibia carries a ridge with two processes which articulate with the corresponding processes of the femur. The distal end of the tibia carries a pair of setae modified into strong spurs, and a varying number of smaller spines.

The *tarsus* (tar) is elongate, broad at the basal half and tapered slightly distally ; composed of two tarsomeres, the first of which is very short, and the second much longer. A *campaniform sensillum* (cam.s) always present on the dorsal surface, at the base of the second tarsomere. Two long and apically-knobbed *tarsal digitules* (tdgt) are usually present near the apex of the tarsus ; these digitules are absent in both *Ceroputo* and *Nairobia* groups.

The *claw* (cl) is slightly curved, uniformly tapering to a sharply pointed tip, and dorsally articulates with the tarsus ; the *ungual digitules* (udgt), one on each side of the claw, are fine, with acute tips.

The ratios of several measurements of the legs were found to be taxonomically useful and the following are here employed : the length of the hind leg to the total body length ; the width of the hind femur to its length ; and the length of the femur to the length of the tibia in the front leg.

Abdomen

The abdomen consists of the largely membranous pregenital segments and the sclerotized genital segment. The segmental boundaries are rather obscure, but the segmentation could be readily determined by the segmental arrangement of the setae and derm pores.

Pregenital segments

Eight pregenital abdominal segments are recognized, and considered to represent either I to VIII abdominal segments by some authors (Theron, 1958 ; Ghauri, 1962 and Giliomee, 1967), and also here adopted), or II to IX by the others (Beardsley, 1960) ; Beardsley explained that his interpretation was based on the position of the posterior dorsal ostioles, equating their position with that established by Ferris (1950) for the females ; Ferris regarded the first abdominal segment (in the females) as completely absent, and that the posterior ostioles lie on what is morphologically the 7th abdominal segment. In a subsequent paper, Beardsley (1962) discussed Theron and Giliomee's views, and considered the abdominal segmentation in Pseudococcidae as an unsettled matter.

The first abdominal segment is developed dorsally and laterally only, and is indiscernible ventrally ; this is indicated by a pair of small tergites, one on each side of the median line ; similar, and even smaller tergites are usually also present on segment II and sometimes III. No tergites occur on segments IV to VII, but segment VIII carries a large, median tergal plate (at8). The ventral sclerotization

is much reduced and only a pair of small, usually triangular plates represent the sternites of segment VIII.

The abdominal segment VI usually bears a pair of dorsal *ostioles* (ost) situated sublaterally near the posterior margin of the segment ; these ostioles are sometimes well developed, prominent and with a slit-like orifice (e.g. *P. citri*), or ill-defined (e.g. *P. obscurus*), or absent altogether (e.g. *N. nipae*). According to Beardsley (1964), two pairs of ostioles, though poorly defined, are present in the females and the apterous males of *Phenacoleachia australis* ; apart from Pseudococcidae and Phenacoleachiidae the ostioles are not recorded in the females or the males of any other coccid family.

The *dermal structures of the pregenital segments* : In *Pseudococcus* group, the *dorsal* and the *ventral setae* (ads & avs) are arranged in transverse bands, composed of both fleshy and hair-like setae ; in the remaining groups where only the hair-like setae are present, they occur in segmental, transverse, irregular rows. The *abdominal pleural setae* (aps) are arranged in lateral groups.

A varying number of *abdominal pleural pores* (app) is usually present on segments I to VII ; sometimes one or more segments of the abdomen are also with *dorsal pores* (adp) (e.g. *O. africanus*, Text-fig. 31), or *ventral pores* (avp) (e.g. *S. sacchari*, Text-fig. 27), or both (e.g. *D. alazon*, Text-fig. 25). A cup-shaped *glandular pouch* (gp) is present on each side of segment VIII near its posterior margin, formed by a cluster of slightly smaller but numerous and tightly packed disc pores ; within the pouch several *setae* (gls) originate, namely :

(a) A pair of long and stout " tail setae " (ts), arising from the centre of the pouch ; these setae are sometimes comparatively short (*Nairobia* group), or moderately long (*Ceroputo* group), or long (the remaining groups).

(b) There are also other shorter setae associated with the long ones : in *Planococcus*, *Pseudococcus* and *Saccharicoccus* groups, a much shorter seta, but conspicuously longer than the body setae, is always present ; in *Ceroputo* and *Nairobia* groups, this seta is subequal in length to the other abdominal setae ; in *Octococcus* group, two setae of medium but subequal lengths, and a short one are present.

In *Ceroputo* group, two pairs of glandular pouches and associated setae are present, one each on segments VII and VIII.

Genital segment and external genitalia

The genital segment is ventrally modified to form a *penial sheath* (ps) (or " genital valve ", Berlese, 1893), which represents the fused lateral parts of the 9th sternum and distally terminates in a rather short projection, the *style* (st). A small sclerotized area occurs dorsally and probably represents the fused 9th tergite and the 10th segment (Theron, 1958), behind which a small *anus* (an) is situated just anterior to the style. The style in lateral view, is slightly curved upwards (e.g. *P. citri*), or straight with a pointed apex (*N. bifrons*), or straight with a rounded apex (e.g. *P. citriculus*). Anteriorly, the ventro-lateral margin of the penial sheath is heavily sclerotized, forming a *basal ridge* (brps). The latter is usually interrupted

medially and partly overlapped by the membrane of abdominal segment VIII, forming there a pair of small internal *projections* (pr) (Giliomee, 1961) ; in *Nairobia* group, the basal ridges of the penial sheath are medially continuous and their projections are absent. Ventrally, at a short distance behind the basal ridges, the penial sheath is longitudinally slit open to allow the protrusion of the aedeagus during copulation ; the edges of this slit are sometimes each produced into well pronounced and heavily sclerotized *processes* (pro) (e.g. *S. sacchari*, Text-figs. 27 & 28), or the processes are vestigal (e.g. *M. hirsutus*, Text-figs. 15 & 16), or entirely absent (e.g. *P. citriculus*, Text-figs. 23 & 24). The term " process " was introduced by Giliomee (1961) for the so-called " opophysis of the genital valve " used by Berlese (1893), " paramere-like projections " by Makel (1942) and " lobular extensions " by Theron (1958).

The *aedeagus* (aed) is connected to the ventral wall of the penial sheath, immediately behind the basal ridges, and supported there by a heavily sclerotized *basal rod* (bra). Dorsally, the aedeagus usually forms a curved tube, almost entirely concealed in the cavity of segment IX when at rest ; in a few species (*M. hirsutus*, Text-figs. 15 & 16 and *P. citriculus*, Text-figs. 23 & 24) the aedeagus is comparatively long and strongly curved anteriorly, reaching the cavity of segment VII. The *ductus ejaculatorius* enters the aedeagus through the *internal genital aperture* (iga) and runs posteriorly towards the gonopore at the apex of the penis (Giliomee, 1961).

The dermal structures

The *setae of the genital segment* (gts) are small and hair-like ; dorsally, 3 setae are usually present on each side of the median line, near the base of the style, but sometimes more than 3 are present, e.g. *C. insolitus* (Text-figs. 35 & 36). Ventrally, a varying number of setae occur on each side of the penial sheath. Few minute *setal sensilla* (pros) may be found on the process of the penial sheath (or its position if absent). Similar *minute sensilla* (sts) may also occur dorsally on the style (*N. bifrons*, Text-figs. 37 & 38).

APTEROUS MALES

The only available wingless male form was that of *S. sacchari* (Text-figs. 29 & 30) ; these are slightly smaller than their winged counterparts. As a result of the complete absence of their wings and hamulohalterae, the sclerite and ridge degeneration is more pronounced, particularly in the mesothoracic region. The differences in body structures as compared with the winged males, are as follows :

Head

The separation of the head from the thorax by a neck region is hardly indicated. The *midcranial ridge* with its dorsal, lateral and ventral arms is entirely absent. The *ocular ridges* (preocular, interocular and postocular) are weakly developed and reduced to variable degrees. The *dorsal* and the *ventral simple eyes* are completely missing and the antennae are 8-segmented and comparatively short.

Thorax

Prothorax : The *pronotal ridge* is more or less reduced and sometimes absent altogether ; the *pronotal sclerites* and the *prosternum* are conspicuously reduced.

Mesothorax : The *mesotergum* is represented only by a weakly sclerotized median sclerite ; the dorsal subdivisions of the mesothorax with its associated structures and apodemes are entirely absent. The *mesopleuron* is greatly reduced and only an atrophied *pleural ridge* supporting anteriorly a small *episternum*, and posteriorly a vestigial *epimeron*, persists. The *mesosternum* is represented by a weakly sclerotized *basisternum*, whose posterior margin is invaginated into a vestigial *furca*.

Metathorax : The *metanotum* is indicated by a transverse median narrow sclerotized patch. A short *pleural ridge*, a small *episternum* and a small *epimeron*, represent the *metapleuron*. The *metasternum* is largely membranous and the *metasternal apophyses* are absent.

Abdomen

The sclerite degeneration is less pronounced in the abdomen ; transverse median narrow tergites and sternites are present on all the pregenital abdominal segments. The *genital segment* and the external genitalia are identical with those of the macropterous forms.

ERIOCOCCIDAE

In the following account, only the condition of the structures characteristic of the males of this family, and which are different from those of Pseudococcidae, will be discussed.

General Characteristics

The studied species were represented by 3 male forms, the macropterous (*E. araucariae*, *E. orariensis*, *E. buxi* and *O. agavium*), the brachypterous (*G. salicicola*) and the apterous (*P. fraxini*) ; macropterous and brachypterous forms of one species, *G. spuria* were also available.

Pupation of the eriococcid males (at least of the species obtained by the writer in the laboratory) takes place within compact, closely felted and rather flattened waxy puparia ; the latter are split open along the rear edge, to allow emergence of the adult males.

Appearance. The macropterous forms are moderately robust, if compared with most of Pseudoccidae ; the brachypterous males are even stouter, with the body broadest at the third abdominal segment ; the apterous males are spindle-shaped. The legs are always well developed.

Size. The males of Eriococcidae share about the same range of variation in size as the Pseudococcidae ; among the species studied the smallest was *P. fraxini*

(518–658, av. 602μ long), and the largest the winged males of *G. spuria* (1442–1512, av. 1484μ long).

Colour. The living specimens show a larger variation in colour than in Pseudococcidae ; sometimes they are light yellowish (*P. fraxini*), light brown (*E. araucariae*) or dark red (*O. agavium*). Some of the material was alcohol-preserved (*Gossyparia* spp.), or already mounted on slides in " Berlese fluid " (*E. orariensis*), or dry samples (*E. buxi*), whose normal colour had changed.

Derm Vestiture. Body setae : The hair-like setae are present on the body and on the appendages ; the fleshy setae may occur on the antennae only (e.g. *Gossyparia* spp.) or on the antennae and the legs (*Eriococcus* spp.), but are always absent on the body itself.

Disc pores : These are entirely absent.

Organs of unknown homology : Peculiar organs (X) appearing as small, irregularly oval or rounded discs, occur dorsally on each side of the midcranial ridge in some species (*E. araucariae* and *Gossyparia* spp.) ; a histological study is required to elucidate their obscure nature, which however was beyond the scope of the present work.

MACROPTEROUS MALES

Head

Head capsule : In front view, the head is usually more or less rounded, but sometimes subtriangular (*E. buxi*). The *ventral preocular depression* is hardly indicated (*Eriococcus* spp.) or entirely absent (*Gossyparia* spp.). The arms of the *midcranial ridge* are always joined together at the apex of the head forming a cruciform structure ; the dorsal arm fades away well before reaching the *postoccipital ridge* (por). The latter is comparatively strong and well developed, with the lateral ends distinctly forked. The *pre-* and the *postocular ridges* (procr & pocr) are widely separated, and the *interocular ridge* is absent ; in *E. buxi*, the ventral part of the preocular ridge is reduced. The corneae of the *dorsal* and the *ventral simple eyes* (dse & vse) are usually subequal in diameter. The lateral pair of *ocelli* (o) are usually well developed and close to the postocular ridges ; in *O. agavium*, they are reduced to small spots only, and attached to the postocular ridges by means of short sclerotized arms. The *cranial apophysis* (ca) is apically bifurcate, except in *E. buxi* where it is truncate. The *tentorial bridge* (tb) is comparatively stout ; the *anterior tentorial arms* (ata) are not fused, each joining the cranial apophysis separately. A small *mouth tubercle* (mt) sometimes occurs just behind the *preoral ridge* (pror) (e.g. *O. agavium*, Text-figs. 45 & 46).

The same groups of head setae which occur in Pseudococcidae are also present in Eriococcidae.

Antennae

The flagellar segments are comparatively short and barrel-shaped, and some-

times the width of the segments, especially of the terminal, becomes equal to their length (e.g. *E. orariensis*, Text-fig. 33), giving the antennae a moniliform rather than a filiform appearance ; usually 10-segmented (9-segmented only in *E. buxi*).

The position of the *antennal bristles* (ab) of the terminal segment is slightly different from that in Pseudococcidae ; sometimes all three bristles are near the base of the segment (*E. buxi*, Text-fig. 43, C), or only the dorsal bristle preapical and the other two at a greater distance from the apex (the remaining spp.). In *E. araucariae* (Text-fig. 39, C) two additional, much smaller bristles are also present on the terminal segment.

The *scape* (scp) is always with 4 hair-like setae, and the *pedicel* (pdc) is comparatively short. The terminal segment is distinctly pear-shaped ; in some species (*O. agavium*) its apex is conspicuously pointed.

Thorax

Prothorax

The prothorax is short. The proepisternum without any ridge-like sclerotizations. The *prosternum* (stnl) is triangular, usually long but sometimes rather short (*G. spuria*) ; the *prosternal ridge* (stnr) is well developed.

The *prothoracic setae :* The *medial pronotal*, the *post-tergital*, the *lateral pronotal* and the *antespiracular dorsal setae* are usually absent.

Mesothorax

The *scutum* (sct) is comparatively short (the prescutum 1–2 times as long) and evenly sclerotized throughout. The *scutellum* (scl) is transversely rectangular, with an additional, strong *scutellar ridge* (sclr), obliquely traversing the scutellum on each side and dividing it into three well defined triangular areas, the largest of which is the median. The width of the scutellum is twice or more its length. The *anterior* and the *posterior ridges of postalare* (apar & ppar) are always joined anteriorly.

The *mesopleural ridge* (plr2) is continuous above the coxal articulation, and the *basalare* (bas) is comparatively stout. The *lateropleurite* (lpl) is large, sometimes with a circular or oval membranous area (e.g. *E. buxi*). The *trochantin* is absent.

The *mesothoracic setae :* The *postmesostigmatal* (pms) and the *basisternal setae* (stn2s) were found only in *E. buxi* ; the other groups of the mesothoracic setae are usually present. Apart from the setae present in Pseudococcidae, few *mesepisternal setae* (eps2s) occur in *E. buxi*, and a minute *lateropleurital seta* (lpls) on each side in *E. orariensis*.

Metathorax

The *suspensorial sclerites* are usually present, but in *O. agavium* they are missing as a result of the complete absence of the hamulohalterae. The *metapostnotal ridge* is always absent. The *precoxal ridge of metathorax* (pcr3) is either well developed (e.g. *E. araucariae*) or rather weak (e.g. *O. agavium*).

The *metathoracic setae :* The *metapleural* (mps) and the *postmetastigmatal setae* (eps3s) are present in *E. buxi* only ; the *posterior metasternal setae* are always absent.

Wings and Hamulohalterae

The *circular sensoria* could not be detected on the wings, and are presumably absent. The *hamulohalterae* are sometimes absent (*O. agavium*, Text-figs. 45 & 46) ; the hooked seta is usually subequal in length to the hamulohaltera (*Eriococcus* spp.), but sometimes considerably shorter (*G. spuria*).

Legs

The fore and the middle legs are usually subequal in length, but sometimes the latter are slightly shorter (*G. spuriae*) ; the hind legs are always longest. The proximal part of the *trochanter* (tr) is distinctly longer than the distal. The *femur* (fem) of the middle leg is always the shortest, and that of the hind leg the longest. The *claw* (cl) is relatively broad at the base and abruptly tapering towards a sharply pointed tip ; the *ungual digitules* (udgt) are distinctly apically knobbed.

Abdomen

Pregenital segments

The *ostioles* are always absent. The *abdominal setae* are arranged in *dorsal* and *ventral* irregular transverse rows, and in *pleural* clusters ; one dorsal seta on each side of segment VIII is noticeably longer than the others. A dorso-median, transverse sclerotization sometimes occurs on segment VIII and anteriorly binds its tergite (*E. buxi*) ; similar, longitudinal sclerotizations may be also present ventrally along the outer margins of the sternites of the same segment (e.g. *E. orariensis*, Text-figs. 41 & 42). The *glandular pouches* (gp) are present only on segment VIII, and their setae (gls) only include a pair of comparatively short *tail setae* (ts) (the body more than 5 times as long).

Genital segment and external genitalia

The structure of the genital segment and the external genitalia is of great taxonomic significance ; it appears to be the most reliable feature distinguishing all forms of Eriococcidae males from those of Pseudococcidae. The basal ridges of the *penial sheath* are medially continuous and modified into a complete, well sclerotized ring. The basal part of the penial sheath is rather long, intimately fused with the 9th tergite + the 10th segment, forming together a compact, cylindrical *genital capsule* (gc). The *anal opening* (an) is comparatively large, and the *style* (st) is usually short but sometimes rather long (e.g. *E. orariensis*, Text-figs. 41 & 42) ; the style in lateral view, is either sinuate (e.g. *E. araucariae*) or straight (e.g. *O. agavium*). Ventrally, the slit-like opening of the penial sheath is removed far posteriorly, and the *aedeagus* (aed) arises at a comparatively large distance from the basal ring of the genital capsule. The aedeagus usually consists of a *basal rod* (bra) and a sclerotized tube, ventrally accommodated within the

style ; in *E. araucariae* the structure of the aedeagus is rather complex, with secondary sclerotizations, as will be discussed in the individual description.

The dermal structures

The dorsal *setae of the genital segment* (gts) always consist of a pair of relatively long and stout setae on each side of the median line, usually near the base of the style. A variable number of smaller setae also occurs ventrally on each side of the genital capsule.

It appears that the structure of the genital segment shows closer relationship of Eriococcidae with Diaspididae than with Pseudococcidae.

BRACHYPTEROUS MALES

In this form, a considerable sclerite degeneration in the meso- and the metathoracic regions is apparent, as a result of the considerable reduction of the fore wings and the hamulohalterae.

Head

A comparatively large *mouth tubercle* (mt) is always present behind the *preoral ridge.*

Thorax

All the meso- and the metathoracic structures become greatly reduced. The *scutellum* is trapezoidal in dorsal view, with the *scuto-scutellar suture* weak or incompletely developed ; the *scutellar ridge* is entirely absent. The *marginal ridge* of the basisternum is slender and partly absent. The *suspensorial sclerite* is absent, and the *metapleural ridge* is dorsally reduced. The *hamulohalterae* if present, are atrophied and without setae or ridges.

Abdomen

The *glandular pouch* and its associated *setae* are greatly reduced, the total length of the body being 12 times or more as long as the setae. The genital segment is similar to that of the macropterous males.

APTEROUS MALES

The form is only represented by the males of *Pseudochermes fraxini.* The sclerite degeneration is most pronounced.

The body is spindle-shaped in the general appearance. The *head* is broadly fused with the thorax ; the *simple eyes* are absent and the *ocelli* represented by small spots or tubercles. Almost all the thoracic features have disappeared, except for a short and vestigial *pleural ridge* on each segment. The *legs* are comparatively short and stout ; the *trochanter* with a long *apical seta,* but apparently without any sensilla. The *glandular pouches* are entirely absent ; the *genital capsule* is small and the *anal opening* minute.

DISCUSSION

This study of the male representatives of Pseudococcidae and Eriococcidae has revealed many interesting facts regarding their taxonomic status. Moreover, the material of Pseudoccidae, being fairly representative (20 spp. were considered), allowed for certain suggestions as to the classification within the family. The material of Eriococcidae, although inadequate for similar suggestions (7 spp. only), was sufficient for a general characterization of the males of the family, and for suggestions regarding the various degrees of morphological relationships between the studied species.

These conclusions were assessed by taking into consideration as many characters as possible, as listed in table I. The table includes all the species here studied and 3 others adequately described for the purpose of comparison by Giliomee (1961). The large number of species studied by Beardsley (1960, 62, 63, 64 and 65) could not be included in this table since his descriptions contain comparatively few of the characters here employed. The assessment of the relationships between the studied species was carried out by using the quantitative evaluation method adopted by Ghauri (1962) and followed by Giliomee (1967). In this method all the characters were regarded as being of equal importance, and those shared by any two species were counted, and the calculated numbers (shown in table II in the form of a matrix) were taken as indices of the degree of affinity. This method was found most practical in the circumstances, although not the most satisfactory from the statistical point of view. The methods recently discussed by Sokal and Sneath (1963), in which a correlation coefficient is obtained for each pair of species, is more accurate, but involves the use of an electronic computer for calculation and the development of a rather elaborate computer programme.*

The discussion, therefore, will include the following aspects :

(A) The taxonomic status of Pseudococcidae and Eriococcidae.

(B) The taxonomic significance of the systematically important characters, and the levels at which they could be used.

(C) The classification and interrelationships within each of these groups.

(D) The relationships of the Pseudococcidae and Eriococcidae with other families of Coccoidea.

(A) Status of Pseudococcidae and Eriococcidae

On examining table I, it was immediately apparent that the pseudococcid and the eriococcid males exhibit a number of structural differences, comparable with those separating other families (e.g. Pseudoccidae and Coccidae), thus justifying the recognition of the two groups as distinct families. This conclusion is in accordance with Ferris's (1937) concepts of classification, which were also adopted by Hoy (1962–63).

* This programme has only recently been developed in the Department of Zoology and Applied Entomology by Dr. G. Murdie, taking the advantage of the computing facilities available in the Imperial College. It was applied too late to include in the main part of the thesis, but the results of the two methods are discussed under Analysis.

TABLE I: CHARACTERS SEPARATING FAMILIES, GROUPS OF GENERA, GENERA AND SPECIES

("NC" indicates "no comparison")	Fam. PSEUDOCOCCIDAE																				Fam. ERIOCOCCIDAE							
	Planococcus Group									Pseudococcus Group						Saccharicoccus Group		Octococcus Group	Ceroputo Group		Nairobia Group							
CHARACTERS	Planococcus citri	P. kenyae	P. dioscoreae	Planococcoides ireneus	Nipaecoccus vastator	N. nipae	Maconellicoccus hirsutus	Ferrisiana virgata	Trionymus newsteadi	Pseudococcus obscurus	P. maritimus (type A)	P. citriculus	P. adonidum	P. fragilis	Dysmicoccus alazon	Saccharicoccus sacchari	" (apterous)	Octococcus africanus	Ceroputo pilosellae	Centrococcus insolitus	Nairobia bifrons	Eriococcus araucariae	E. orariensis	E. buxi	Ovaticoccus agavium	Gossyparia spuria	" (brachypterous)	G. salicicola (brachypterous)	Pseudochermes fraxini (apterous)
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		17	18	19	20	21	22	23	24	25		26	27
General appearance: (1) Narrow and slender. (2) Moderately robust (3) Robust	←								1							→	←	2→	←	1	→	←		2		→	←3	→	2
Size: (1) Small (about 1000 µ or less). (2) Intermediate. (3) Large (about 1250 µ long or more).	←2	→	3	←2	→	1	2	←3	→	2	←		3			→	2	1	2	←3	→	2	←1	→	2	←3		→	1
Fleshy setae: (1) Entirely absent. (2) Only on the antennae. (3) On the antennae and legs. (4) On the body itself, antennae and legs.	←	3		→	2	←	3	→	2	←		4			→	←3	→	2	1	3	1	←	3	→	←		2		→

Derm pores: (1) Absent. (2) On thorax and abdomen only. (3) Present on head, thorax and abdomen.

HEAD:

In front view: (1) Subtriangular. (2) More or less rounded. (3) Dorso-ventrally flattened.

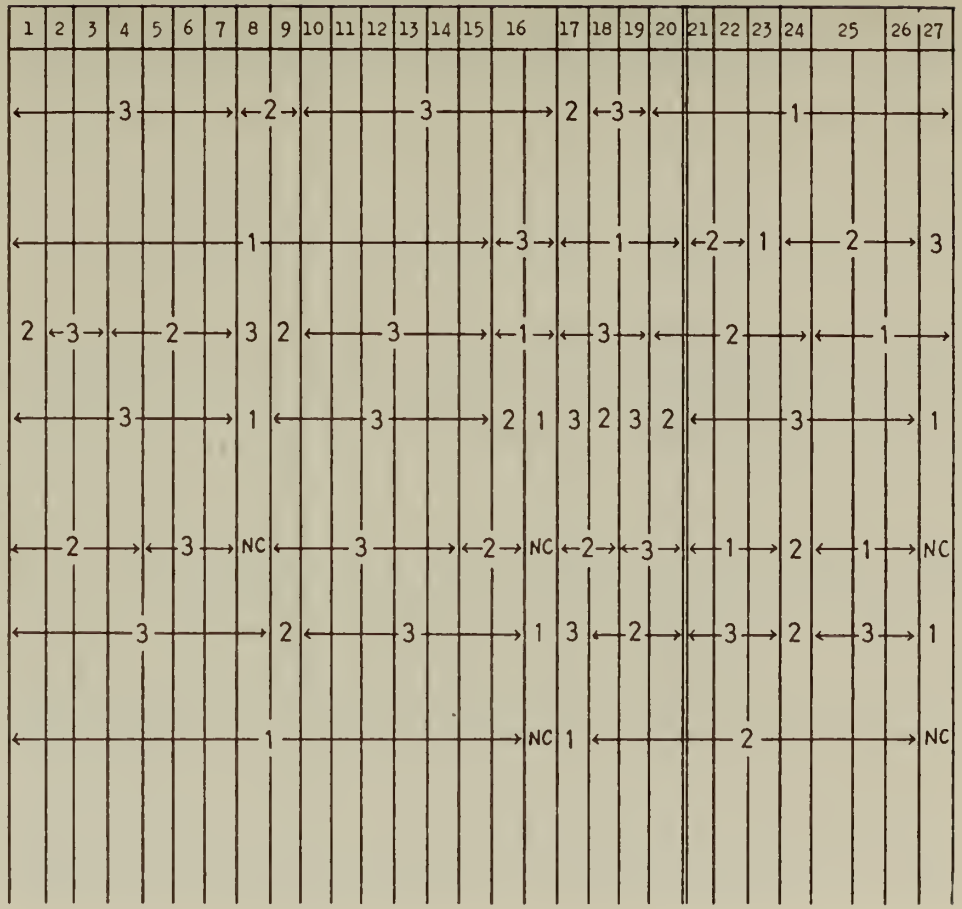
In Lateral view: Ventral preocular depression: (1) Entirely absent (2) Hardly indicated. (3) Well pronounced.

Dorsal arm of midcranial ridge: (1) Absent. (2) Indicated by heavy sclerotization. (3) Distinct.

If present: (1) Posteriorly disappearing at or anterior to level of dorsal eyes. (2) Disappearing behind the level of the dorsal eyes. (3) Meeting or almost meeting the postoccipital ridge.

Lateral arms of the midcranial ridge: (1) Absent. (2) Indicated by weak sclerotization. (3) Well developed.

Relationship between the arms of the midcranial ridge: (1) Dorsal arm separated. (2) All arms joined forming a cruciform structure.



Postoccipital ridge: (1) Absent (2) Its position only marked by heavy sclerotization. (3) Distinct, slender and U-shaped. (4) Slender and V-shsped. (5) Strongly developed and laterally forked.

(1) Anteriorly not reaching the preocular ridges. (2) Confluent with the preocular ridges.

Pre and postocular ridges: (1) Absent (2) Widely separated. (3) Joined together by means of the interocular ridge.

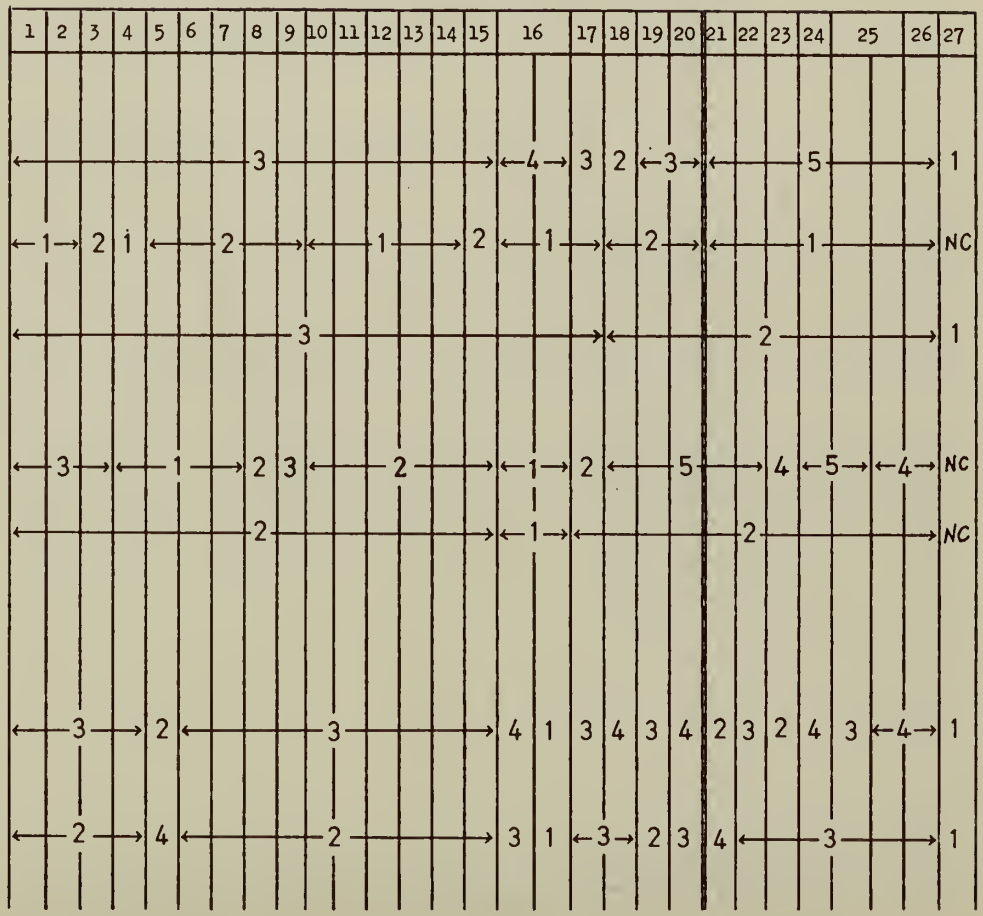
The ventral part of the preocular ridge, below the srticulsr process: (1) Entirely absent. (2) Ill defined. (3) Well marked by a heavy sclerotization. (4) Atrophied. (5) The ridge well developed ventrally.

The dorsal part of the postocular ridge: (1) Reduced. (2) Well-developed.

EYES:

Distance between dorsal eyes in relation to diameter of their corneae: (1) Simple eyes sbsent. (2) Distance usually less than 3.5 times the diameter of cornese. (3) Distance usually 3.5-6 times. (4) Distance usually more than 6 times.

Relative size of simple eyes: (1) Absent. (2) Dorsal eyes smaller than the ventral. (3) Both eyes subequal. (4) Ventral eyes smsller.



Lateral ocelli: Vestigial or merely represented by small sclerotized spots. (2) Well developed.

Position of ocelli: (1) Independent on head wall. (2) Ocular ridges sepsrsted; ocellus closely attached to postocular ridge. (3) Ocular ridges sepsrated; ocellus attached to postoculsr ridge by means of a sclerotized arm. (4) Ocular ridges separated; ocellus attached to postocular ridge by means of a well developed ridge. (5) Pre and postocular ridges joined by the interocular ridge; ocellus at the point of junction.

Cranial apophysis: (1) Truncate. (2) Apically bifurcate.

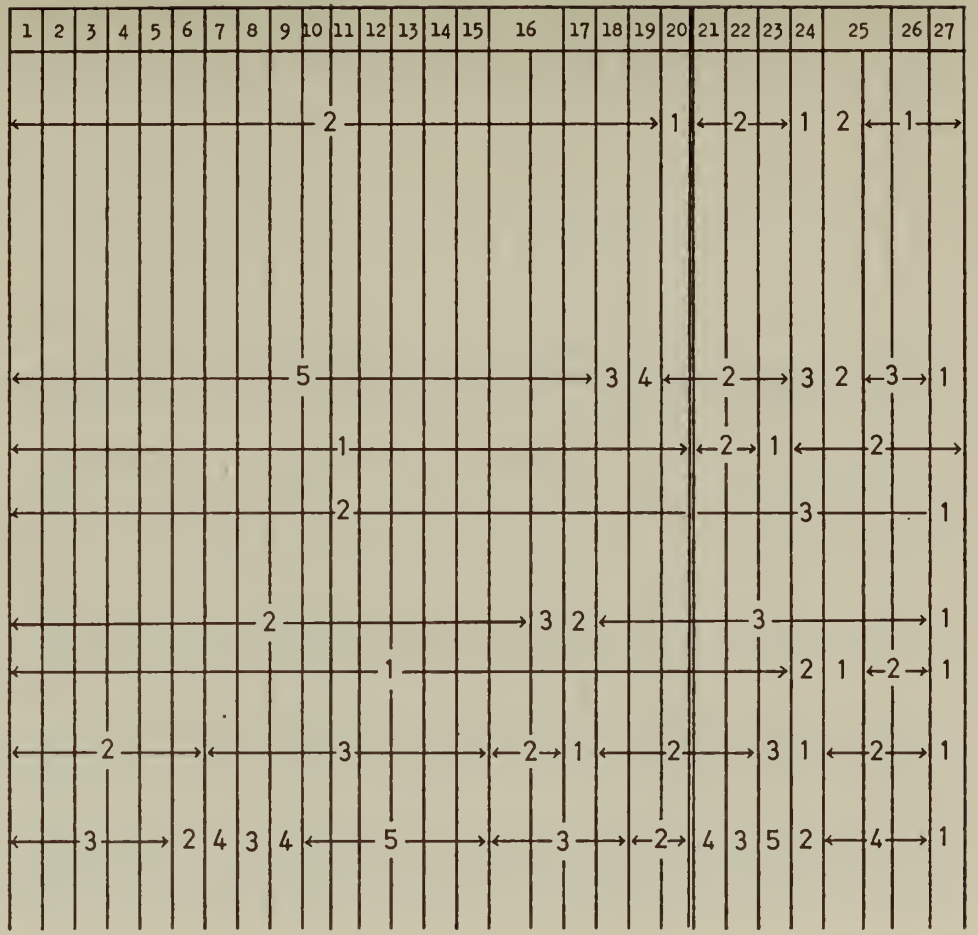
Tentorial bridge: (1) Absent. (2) Comparatively slender. (3) Stout.

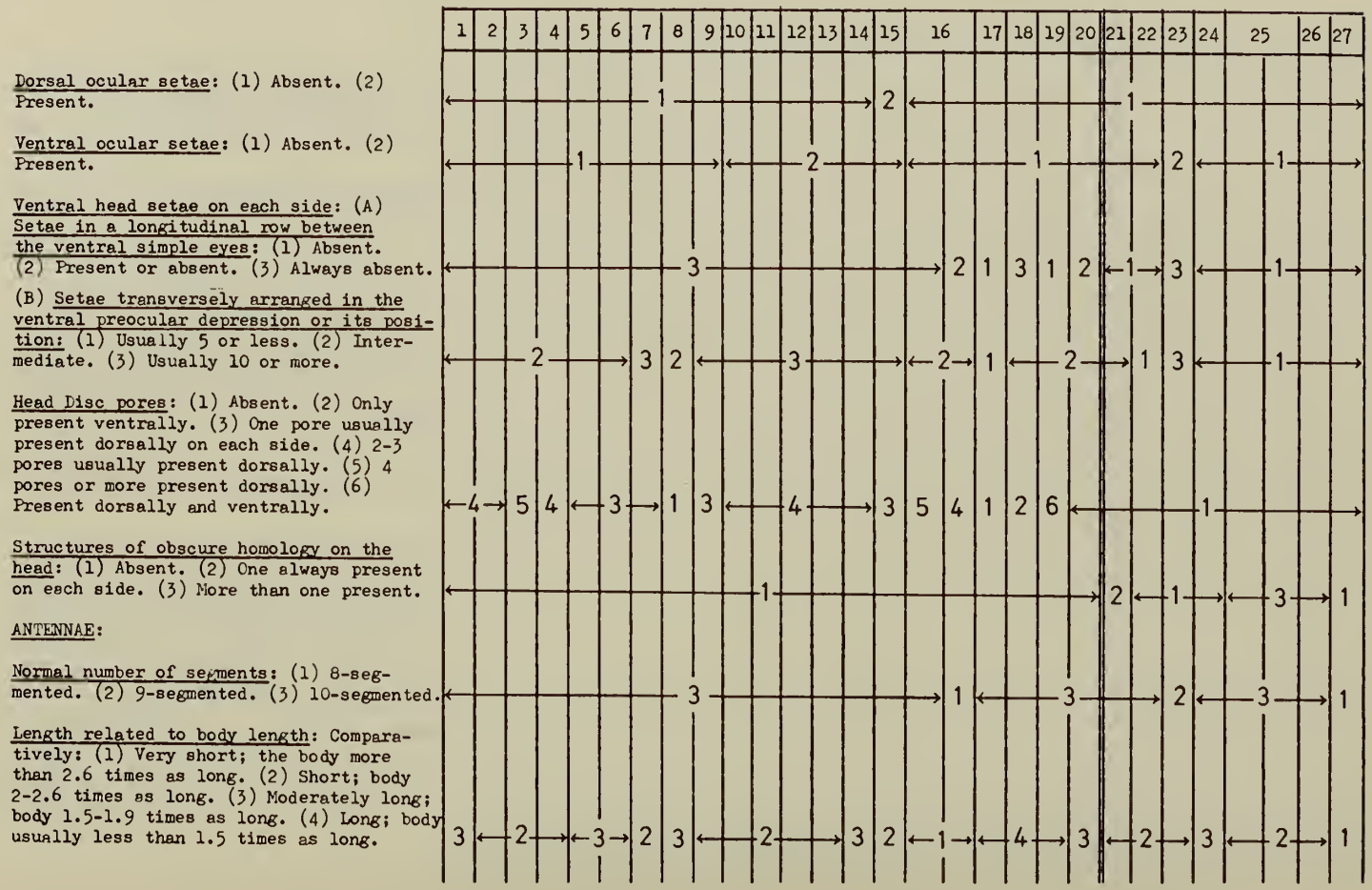
Anterior Tentorial arms: (1) Absent. (2) Anteriorly fused together before merging into the cranial apophysis. (3) Well separated.

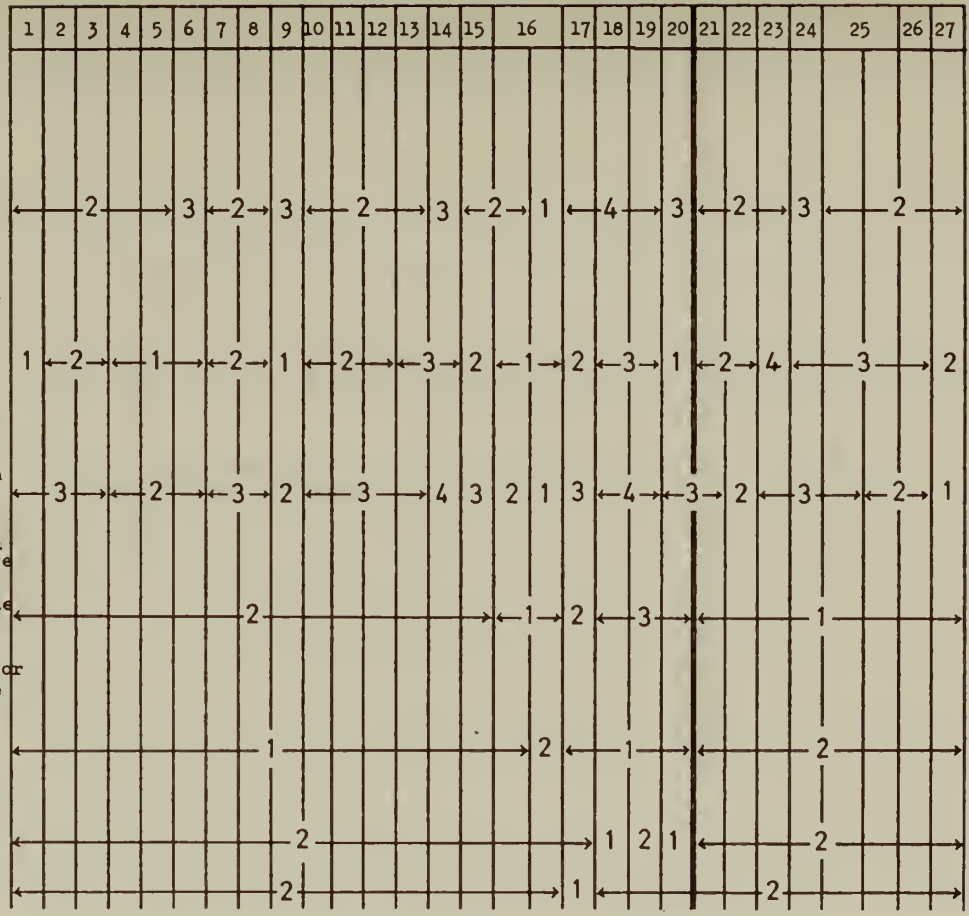
Mouth tubercle: (1) Absent. (2) Present.

Dorsal head setae on each side: (1) Usually less than 8. (2) Intermediate. (3) Usually more than 12.

Genal setae on each gena: (1) Absent. (2) 1-2 usually. (3) Almost always 3. (4) Varying number, 1-7. (5) More than 7.




1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Dorsal ocular setae: (1) Absent. (2) Present.
Ventral ocular setae: (1) Absent. (2) Present.
Ventral head setae on each side: (A) Setae in a longitudinal row between the ventral simple eyes: (1) Absent. (2) Present or absent. (3) Always absent.
(B) Setae transversely arranged in the ventral preocular depression or its position: (1) Usually 5 or less. (2) Intermediate. (3) Usually 10 or more.
Head Disc pores: (1) Absent. (2) Only present ventrally. (3) One pore usually present dorsally on each side. (4) 2-3 pores usually present dorsally. (5) 4 pores or more present dorsally. (6) Present dorsally and ventrally.
Structures of obscure homology on the head: (1) Absent. (2) One always present on each side. (3) More than one present.
ANTENNAE:
Normal number of segments: (1) 8-segmented. (2) 9-segmented. (3) 10-segmented.
Length related to body length: Comparatively: (1) Very short; the body more than 2.6 times as long. (2) Short; body 2-2.6 times as long. (3) Moderately long; body 1.5-1.9 times as long. (4) Long; body usually less than 1.5 times as long.



Length in relation to length of hind legs: (1) Antennae much shorter; the hind legs more than 1.6 times as long. (2) Antennae slightly shorter; the hind legs 1.1-1.6 times as long (3) Both subequal. (4) Antennae longer.

Relative length of 3rd and terminal antennal segments: (1) Both subequal. (2) Segment III slightly longer, usually 1.1-1.5 times as long. (3) Segment III 1.5-2.5 times as long. (4) Segment III more than 2.5 times as long.

Width of segment III in relation to its length: (1) Length less than twice the width. (2) Length 2-3.3 times as wide. (3) Length 3.3 - 5.3 as wide. (4) Length more than 5.3 times as wide.

Width of preterminal segment in relation to its length: (1) Length less than twice the width. (2) Length 2-3.7 times the width. (3) Length more than 3.7 times the width.

Shape of the terminal segment: (1) More or less cylindrical, i.e. of about the same width throughout. (2) Pear-shaped, i.e. wide at base and becoming gradually narrower apically.

Antennal setae:

Fleshy setae: (1) Absent. (2) Present.

Hair-like setae on segments: IV to terminal: (1) Absent. (2) Present.

Relative length of the antennal and the body setae: (1) Subequal or slightly longer than the body setas. (2) Twice as long as body setae or more.

Capitate, apically knobbed sensory setae: (1) Absent. (2) Two subapical setae present on terminal segment only. (3) 5-6 setas on terminal segment only. (4) Few setae present on segments VII to X, and sometimss also on segments III to VI. (5) Always present on segments III to X and forming the majority of the antennal setas.

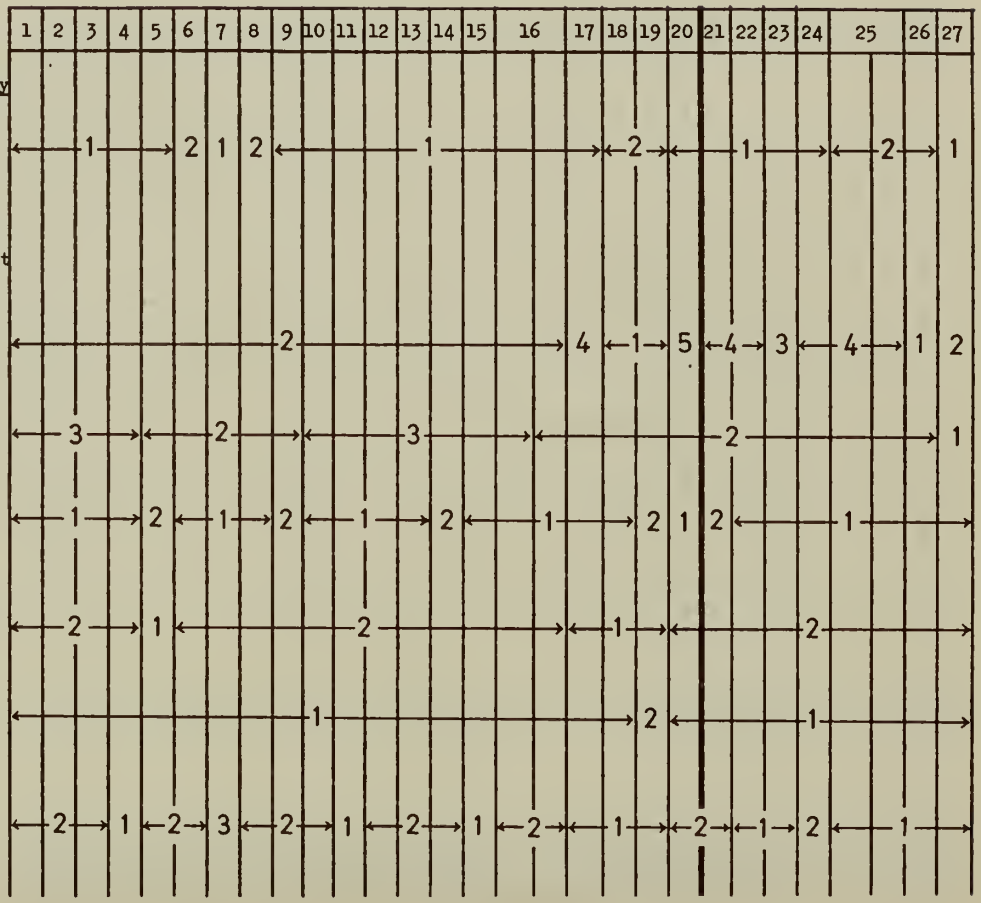
Number of hair-like setae on the scape: (1) 1-3 h.s. (2) 4 h.s. almost always present. (3) More than 4 h.s. present.

Antennal bristles (ab) on terminal segment: (1) 3 bristles only present. (2) 3 rslatively large, and 2 much smaller.

The three large bristles: (1) Slightly stouter than the antsnnal setae and hardly distinguishable. (2) Conspicuously stouter and easily separated.

(1) The two lateral bristles about as long as those on the two preceding ssgmsnts. (2) Approximately twics as long.

Rslative length: (1) All of about ths same length. (2) The dorsal bristle slightly shorter. (3) The dorsal bristle much shorter (about half ss long).



Position: (1) All three preapical, at about the same distance from the apex. (2) The lateral pair preapical and the dorsal bristle removed a great distance from the apex (nearly at half the segment's length). (3) The doraal bristle preapical and the lateral pair near the base of the segment. (4) All three near the base.

Apical hair-like seta of the terminal segment: (1) Present. (2) Replaced by 1-3 preapical sensilla basiconica.

THORAX:

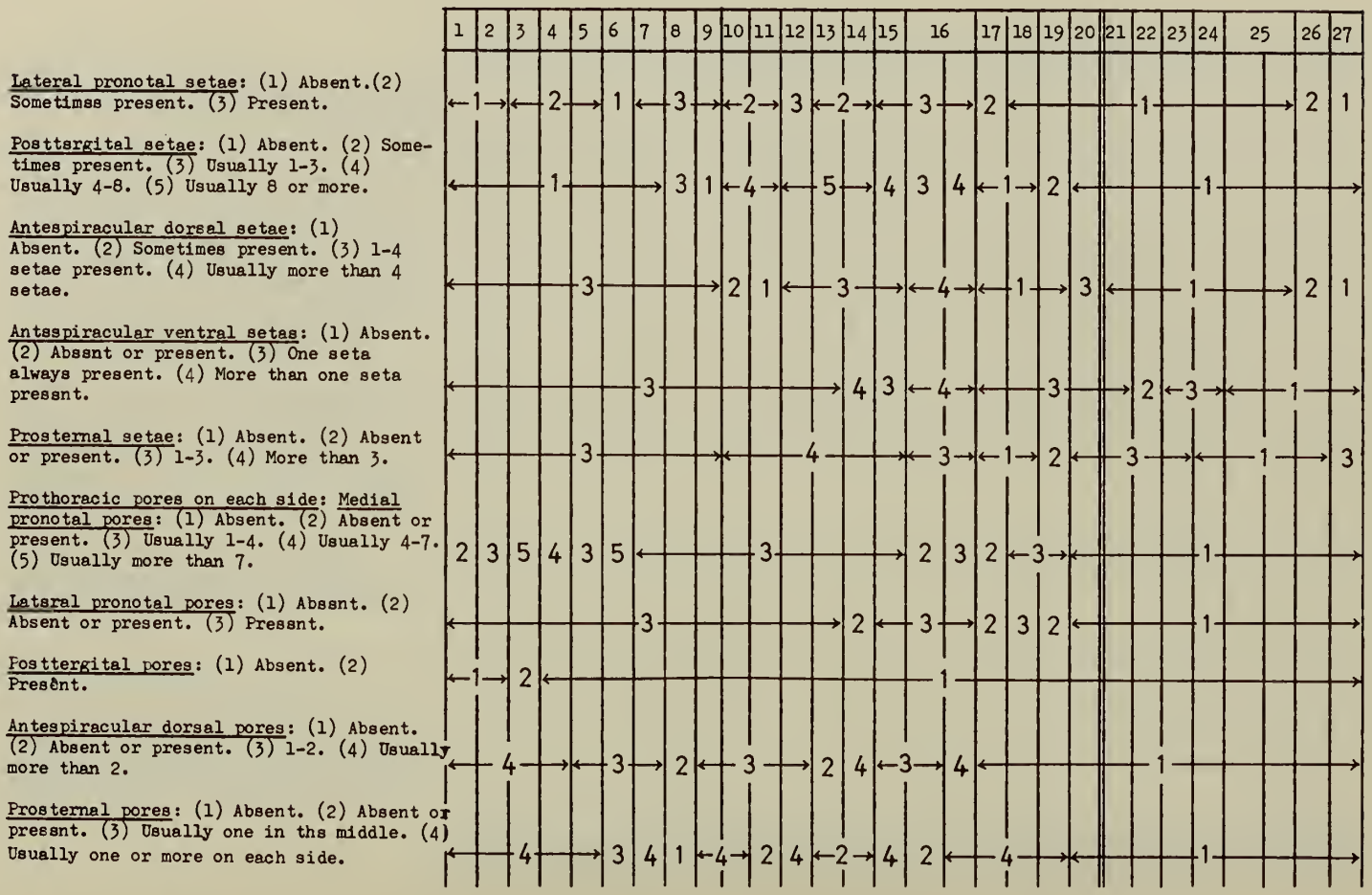
PROTHORAX:

Proepisternum: (1) Without ridge-like sclerotization. (2) Dorsal margin ridge-like. (3) Dorsal and ventral margins ridge-like.

Shape of Prosternum: (1) Absent. (2) Short, triangular plate. (3) Comparatively long, triangular. (4) Triangular with the anterior apex forming a sclerotized ring. (5) A long and narrow plate. (6) A pair of separate plates.

Prosternal ridge: (1) Absent. (2) Its position only marked by heavy sclerotization. (3) A single ridge. (4) With anteromedian, crescent-like extension. (5) Doubled.

Prothoracic setae on each side: Medial pronotal setae: (1) Usually absent. (2) 1 or 2 (3) Usually more than 2.


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Lateral pronotal setae: (1) Absent.(2) Sometimss present. (3) Present.
Posttsrgital setae: (1) Absent. (2) Sometimes present. (3) Usually 1-3. (4) Usually 4-8. (5) Usually 8 or more.
Antespiracular dorsal setae: (1) Absent. (2) Sometimes present. (3) 1-4 setae present. (4) Usually more than 4 setae.
Antsspiracular ventral setas: (1) Absent. (2) Absnt or present. (3) One seta always present. (4) More than one seta pressnt.
Prosternal setae: (1) Absent. (2) Absent or present. (3) 1-3. (4) More than 3.
Prothoracic pores on each side: Medial pronotal pores: (1) Absent. (2) Absent or present. (3) Usually 1-4. (4) Usually 4-7. (5) Usually more than 7.
Latsral pronotal pores: (1) Absnt. (2) Absent or present. (3) Pressnt.
Posttergital pores: (1) Absent. (2) Presẽnt.
Antespiracular dorsal pores: (1) Absent. (2) Absent or present. (3) 1-2. (4) Usually more than 2.
Prosternal pores: (1) Absent. (2) Absent or pressnt. (3) Usually one in ths middle. (4) Usually one or more on each side.

MESOTHORAX:

Prescutum:

Appearance in dorsal view: (1) Not differentiated. (2) Transverse, rectangular, with well separated prescutal ridges. (3) Triangular, with well separated ridges. (4) Triangular, with the prescutal ridges continuous medioposteriorly.

Relative length to width of prescutum: (1) Width equal to length or slightly longer. (2) Width 1.4-2 times the length. (3) Width more than twice the length.

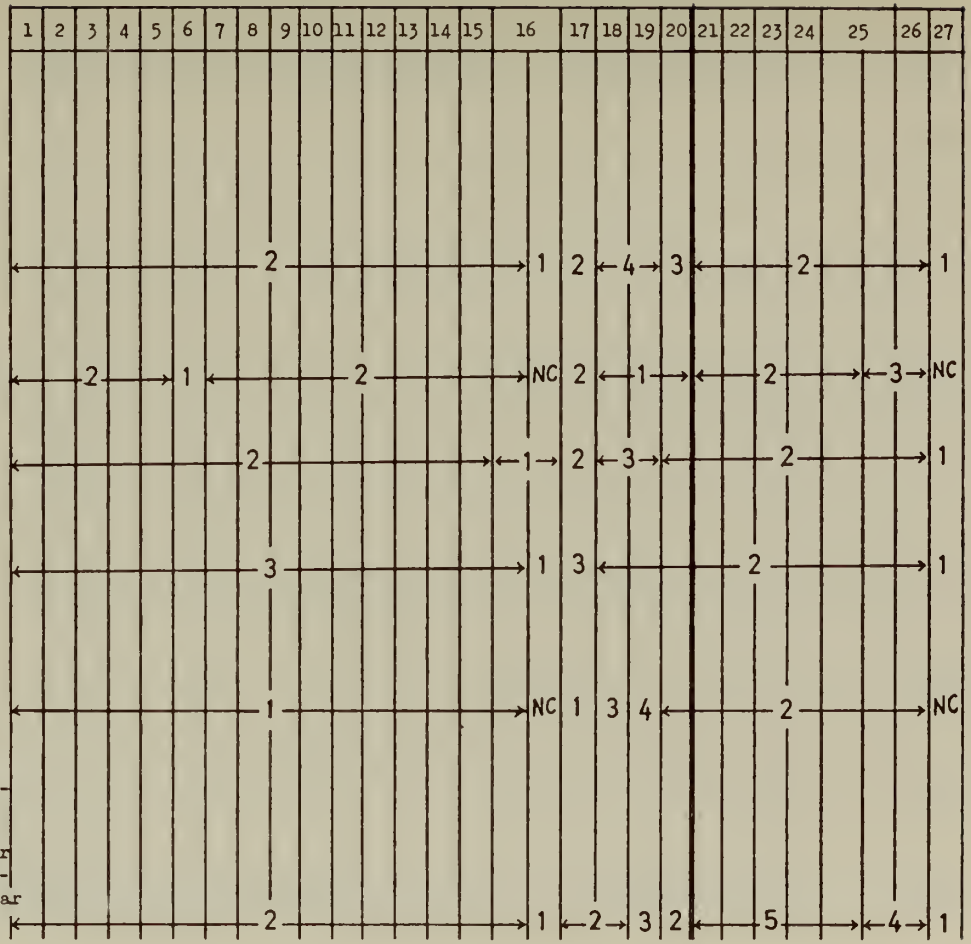
Prescutal suture: (1) Absent. (2) Distinct. (3) Replaced by the continuous prescutsl ridges.

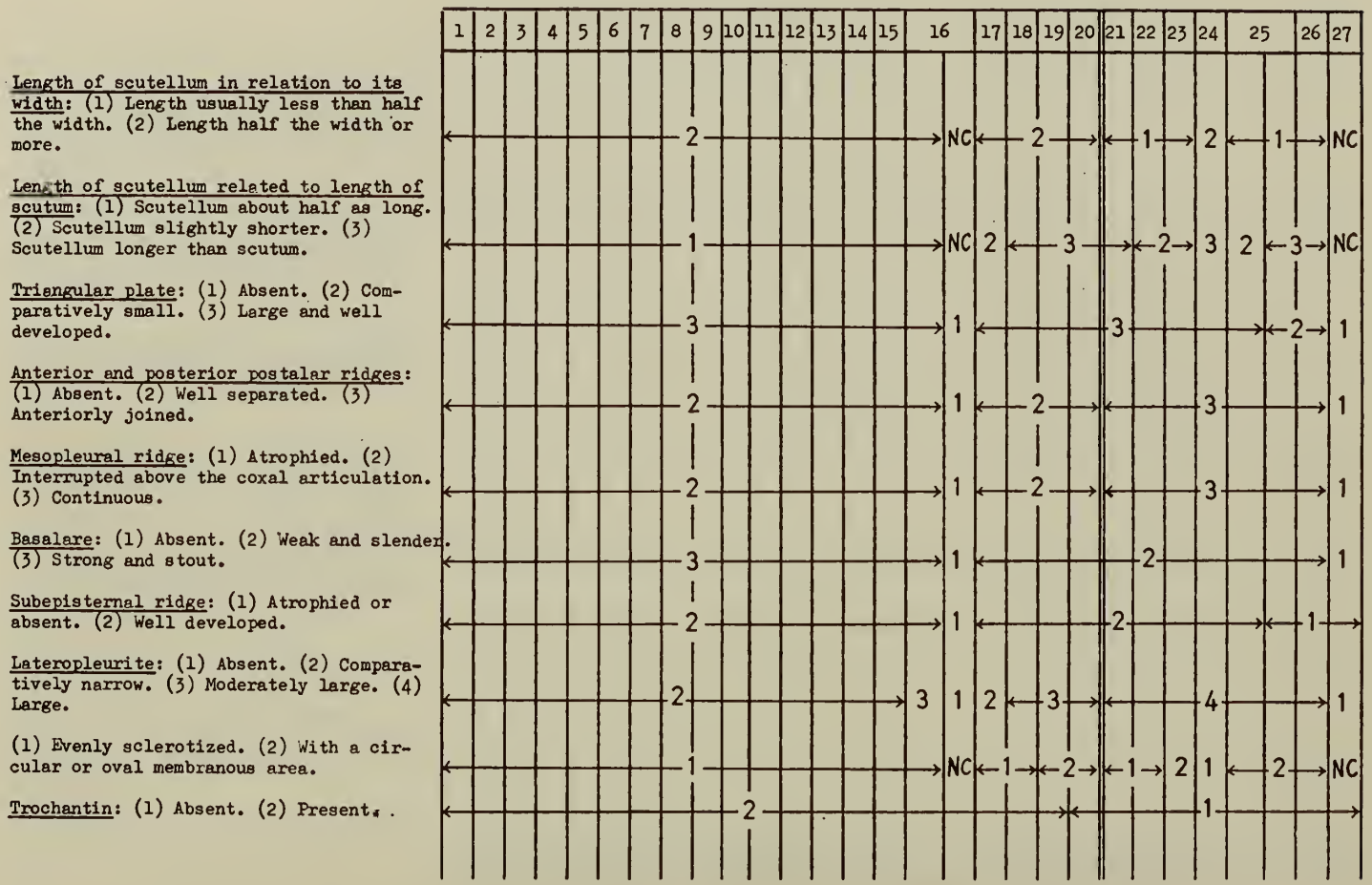
Scutum: (1) Not differentiated. (2) Evenly sclerotized. (3) With a distinct, median, longitudinal narrow membranous area.

Relative length of prescutum to scutum: (1) Prescutum shorter than scutum. (2) Prescutum 1-2 times as long as scutum. (3) Prescutum 2-4 times as long. (4) Prescutum more than 4 times as long.

Scutellum:

Appearance in dorsal view: (1) Not differentiated. (2) Pentagonal. (3) Pentagonal with a lateral sdditional ridge on each side. (4) Trapezoid-shaped; scutoscutellar suture partly absent. (5) Transverse, rectangular, with strongly developed scutellar ridges.





Length of scutellum in relation to its width: (1) Length usually less than half the width. (2) Length half the width or more.

Length of scutellum related to length of scutum: (1) Scutellum about half as long. (2) Scutellum slightly shorter. (3) Scutellum longer than scutum.

Triangular plate: (1) Absent. (2) Comparatively small. (3) Large and well developed.

Anterior and posterior postalar ridges: (1) Absent. (2) Well separated. (3) Anteriorly joined.

Mesopleural ridge: (1) Atrophied. (2) Interrupted above the coxal articulation. (3) Continuous.

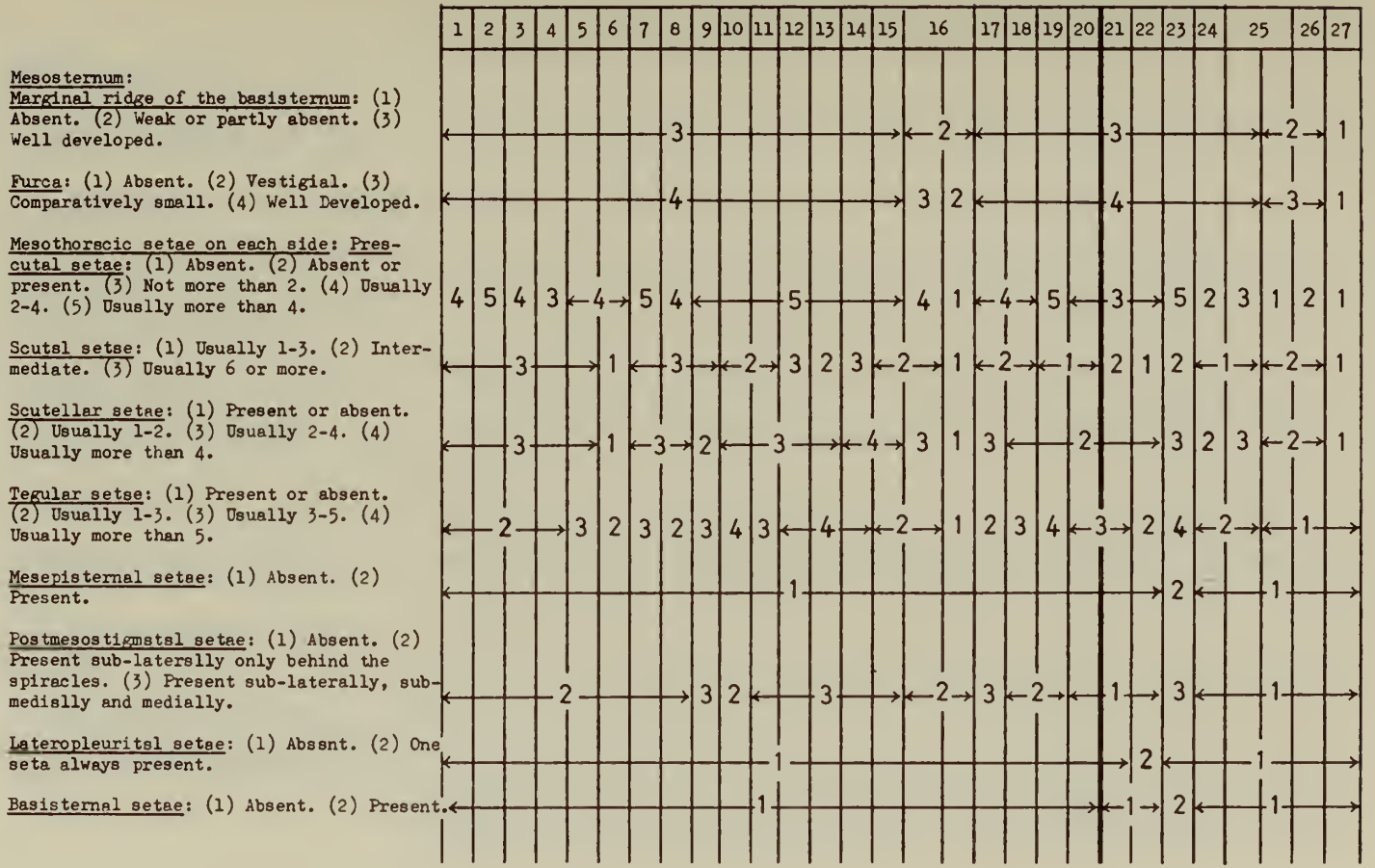
Basalare: (1) Absent. (2) Weak and slender. (3) Strong and stout.

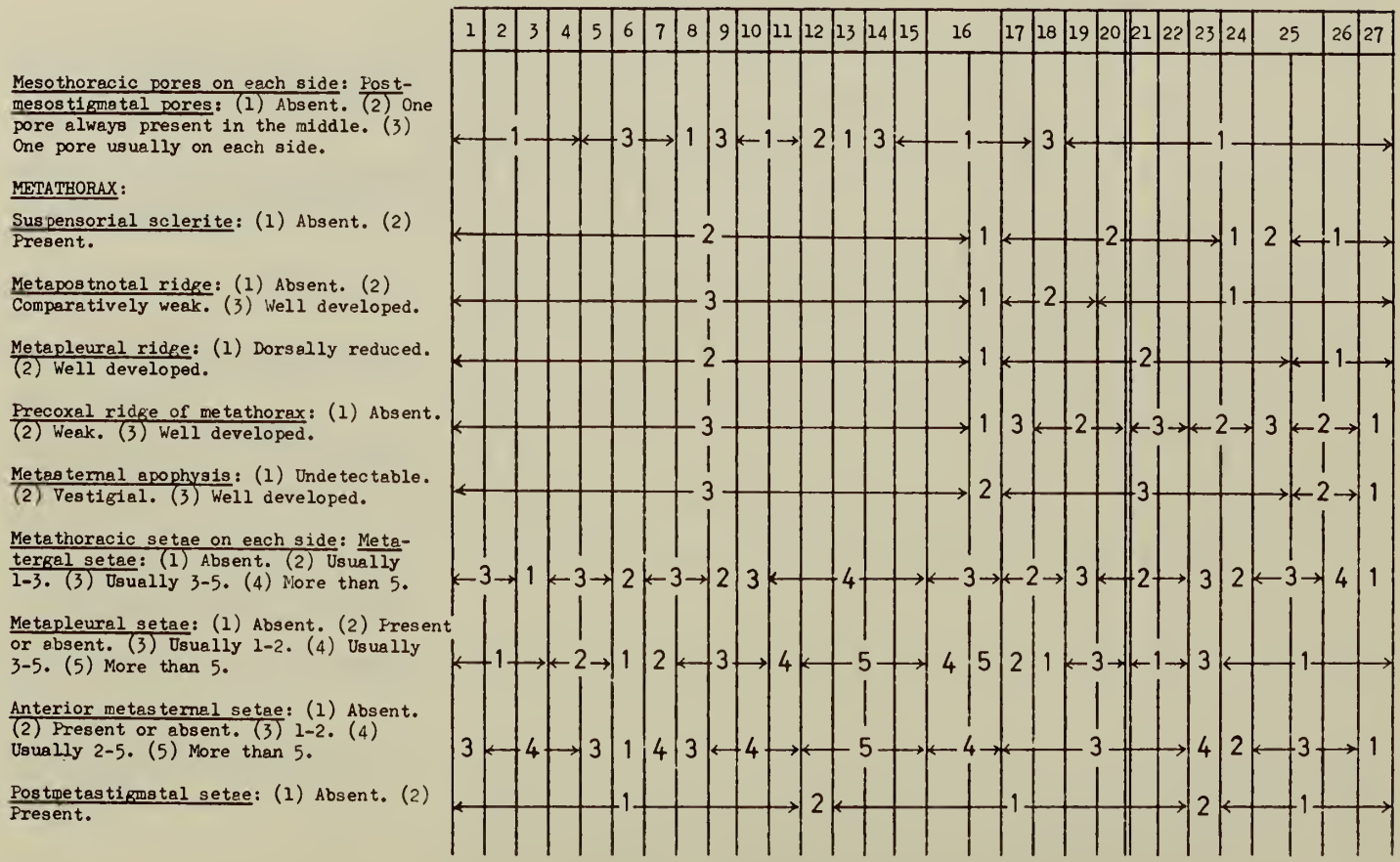
Subepisternal ridge: (1) Atrophied or absent. (2) Well developed.

Lateropleurite: (1) Absent. (2) Comparatively narrow. (3) Moderately large. (4) Large.

(1) Evenly sclerotized. (2) With a circular or oval membranous area.

Trochantin: (1) Absent. (2) Present.


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
3 2 3 2 1
4 3 2 4 3 1
4 5 4 3 4 5 4 5 4 1 4 5 3 5 2 3 1 2 1
3 1 3 2 3 2 3 2 1 2 1 2 1 2 1 2 1
3 1 3 2 3 4 3 1 3 2 3 2 1
2 3 2 3 2 3 4 3 4 2 1 2 3 4 3 2 4 2 1
1 2 1
2 3 2 3 2 3 2 1 3 1
1 2 1
1 1 2 1
Mesosternum:
Marginal ridge of the basisternum: (1) Absent. (2) Weak or partly absent. (3) Well developed.
Furca: (1) Absent. (2) Vestigial. (3) Comparatively small. (4) Well Developed.
Mesothorscic setae on each side: Prescutal setae: (1) Absent. (2) Absent or present. (3) Not more than 2. (4) Usually 2-4. (5) Usually more than 4.
Scutsl setse: (1) Usually 1-3. (2) Intermediate. (3) Usually 6 or more.
Scutellar setae: (1) Present or absent. (2) Usually 1-2. (3) Usually 2-4. (4) Usually more than 4.
Tegular setse: (1) Present or absent. (2) Usually 1-3. (3) Usually 3-5. (4) Usually more than 5.
Mesepisternal setae: (1) Absent. (2) Present.
Postmesostigmstsl setae: (1) Absent. (2) Present sub-latersllv only behind the spiracles. (3) Present sub-laterally, submedislly and medially.
Lateropleuritsl setae: (1) Absent. (2) One seta always present.
Basisternal setae: (1) Absent. (2) Present.


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Mesothoracic pores on each side: Post-mesostigmatal pores: (1) Absent. (2) One pore always present in the middle. (3) One pore usually on each side.
METATHORAX:
Suspensorial sclerite: (1) Absent. (2) Present.
Metapostnotal ridge: (1) Absent. (2) Comparatively weak. (3) Well developed.
Metapleural ridge: (1) Dorsally reduced. (2) Well developed.
Precoxal ridge of metathorax: (1) Absent. (2) Weak. (3) Well developed.
Metasternal apophysis: (1) Undetectable. (2) Vestigial. (3) Well developed.
Metathoracic setae on each side: Metatergal setae: (1) Absent. (2) Usually 1-3. (3) Usually 3-5. (4) More than 5.
Metapleural setae: (1) Absent. (2) Present or absent. (3) Usually 1-2. (4) Usually 3-5. (5) More than 5.
Anterior metasternal setae: (1) Absent. (2) Present or absent. (3) 1-2. (4) Usually 2-5. (5) More than 5.
Postmetastigmatal setae: (1) Absent. (2) Present.

Posterior metasternal setae: (1) Absent. (2) Absent or present. (3) 1-2 setae. (4) Usually more than 2 setae.

Metathoracic pores: Metatergal pores: (1) Absent. (2) Usually present.

Metaspiracular pores: (1) Absent. (2) Sometimes present. (3) Present.

Anterior metasternal pores: (1) Absent. (2) Sometimes present. (3) Present.

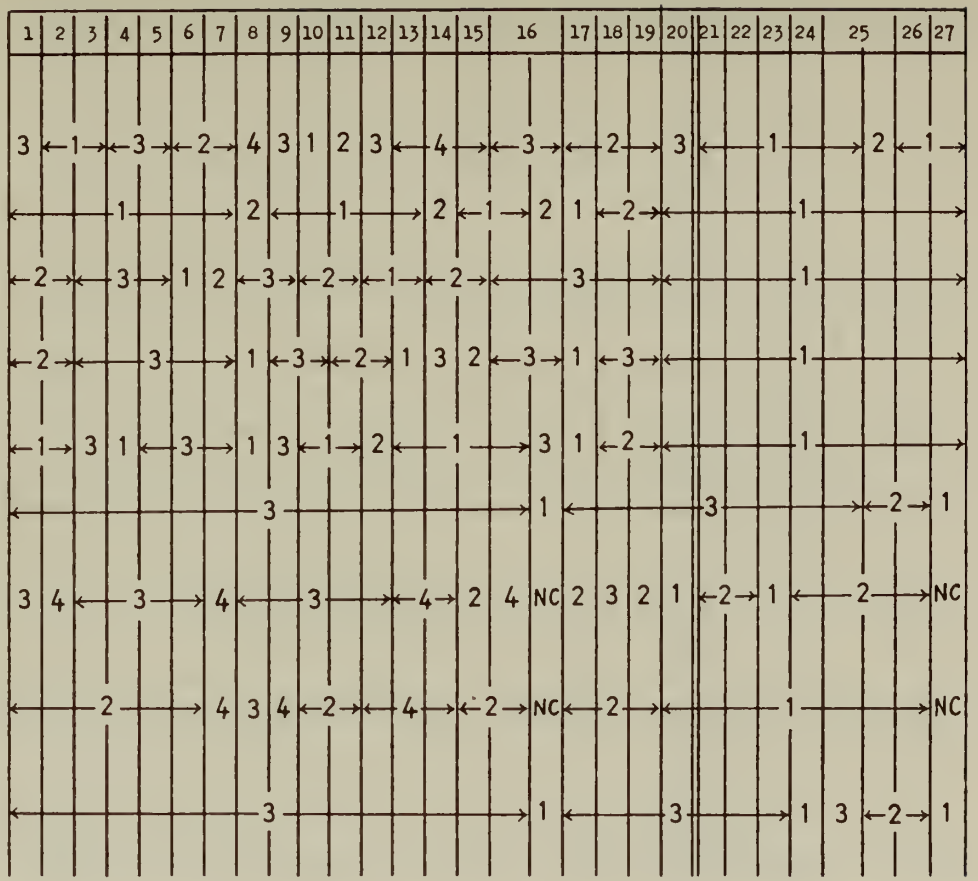
Posterior metasternal pores: (1) Absent. (2) Sometimes present. (3) Present.

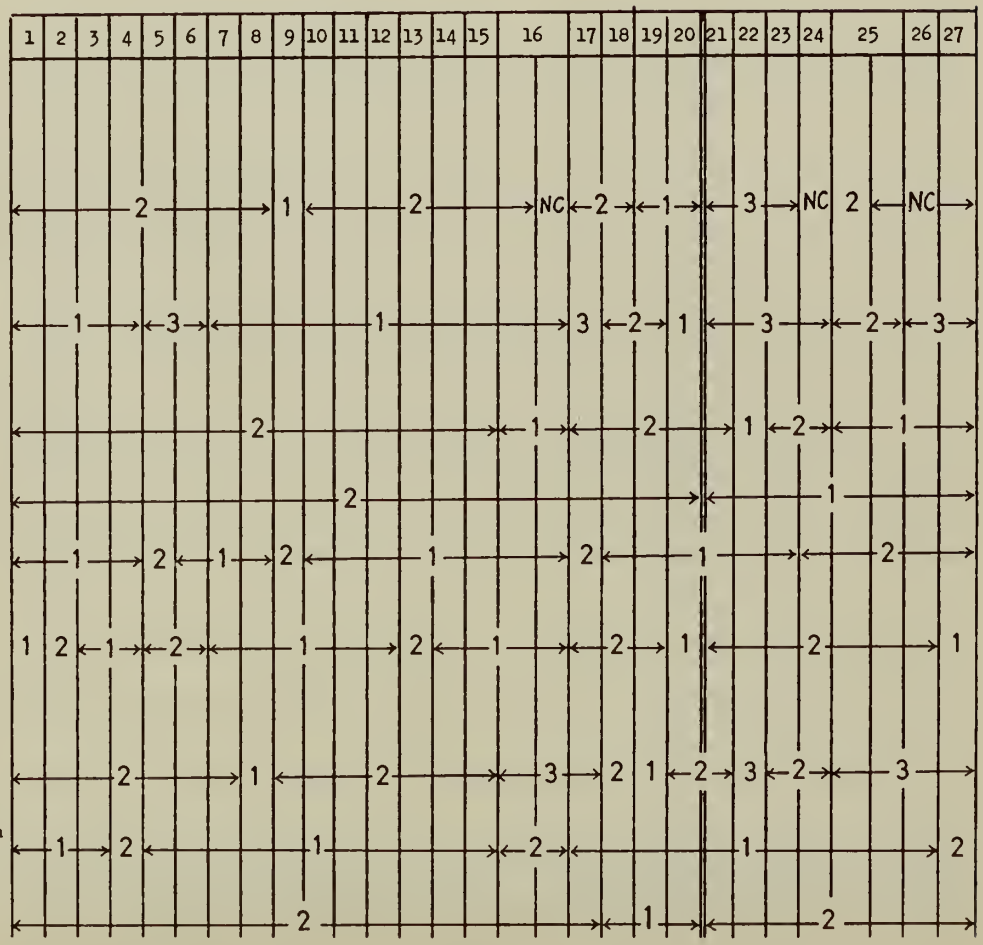
Fore-wings: (1) Absent. (2) Reduced. (3) Well developed.

Alar setae: (1) Usually absent. (2) Usually 1-3. (3) Almost always 3. (4) Usually more than 3.

If Wings well developed: Circular sensoria: (1) Could not be detected and presumably absent. (2) 2-3. (3) Always 3. (4) 3-4.

Hamulohalterae: (1) Absent. (2) Atrophied, without setae. (3) Well developed, with one apically hooked seta.





If well developed: Length of seta in relation to length of hamulohaltera: (1) Seta much shorter (hamulohaltera 1.9 times or more as long. (2) Seta slightly shorter (hamulohaltera usually lsss than 1.9 times as long. (3) Both subequal.

LEGS:

(1) Foreleg shortest. (2) Middle leg shortest. (3) Both subequal.

Length of hind leg in relation to length of body: (1) Hind leg less than half the body lsngth. (2) Hind leg half or more the body length.

Trochanter: (1) Basal part shorter than the distal. (2) Basal part longer.

Apical seta of trochanter: (1) Absent. (2) Pressnt.

Femur: (1) Front femur shortest or equal to middle femur. (2) Middls femur shortest.

Width of hind femur in relation to its lsngth: (1) Comparatively slender (length 6.5 times or mors as width). (2) Intermediate. (3) Stout (length 4.2 times or less as width).

In foreleg: (1) Femur shorter than tibia (2) Femur longer than tibia.

Tarsal digitules: (1) Absent. (2) Present.

Claw: (1) Uniformly tapering apically. (2) Broad basally and abruptly tapering apically.

Ungual digitules: (1) Not knobbed apically. (2) Apically knobbed.

ABDOMEN:

Ostioles: (1) Absent. (2) Ill-defined. (3) Well developed.

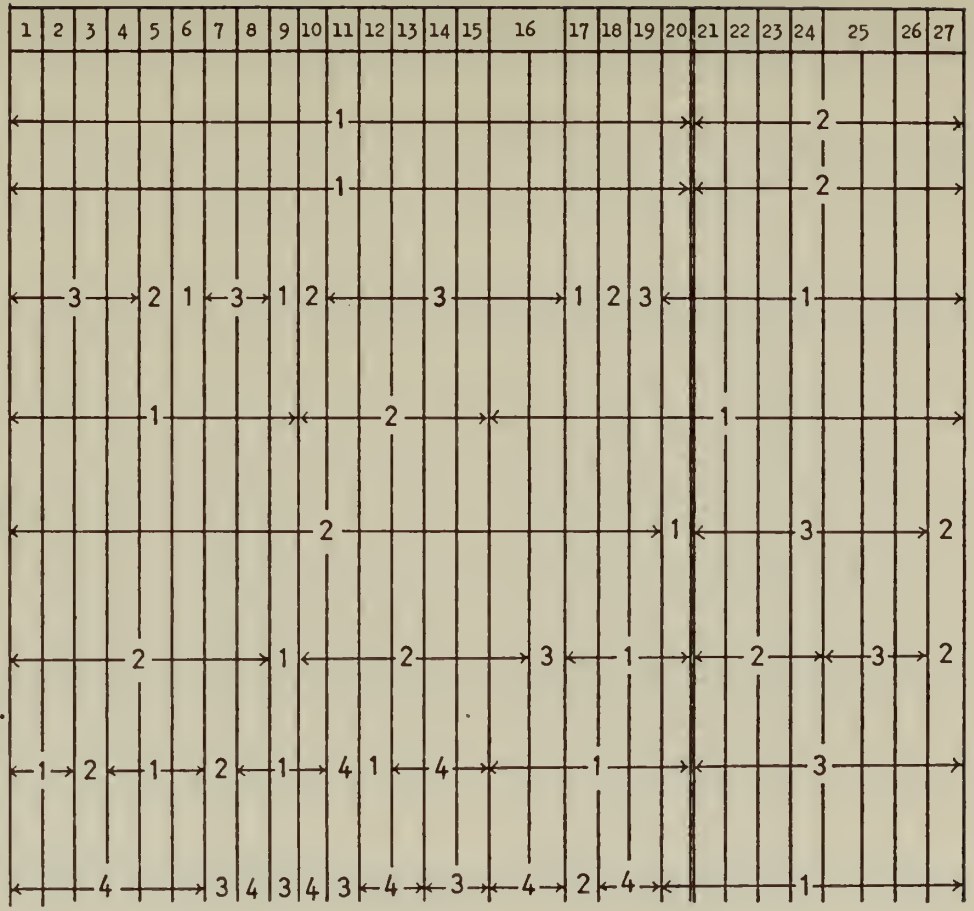
Abdominal setae: (1) Dorsal and ventral setae hair-like, segmentally arranged in transverse rows. (2) Both fleshy and hair-like setae present in segmental bands.

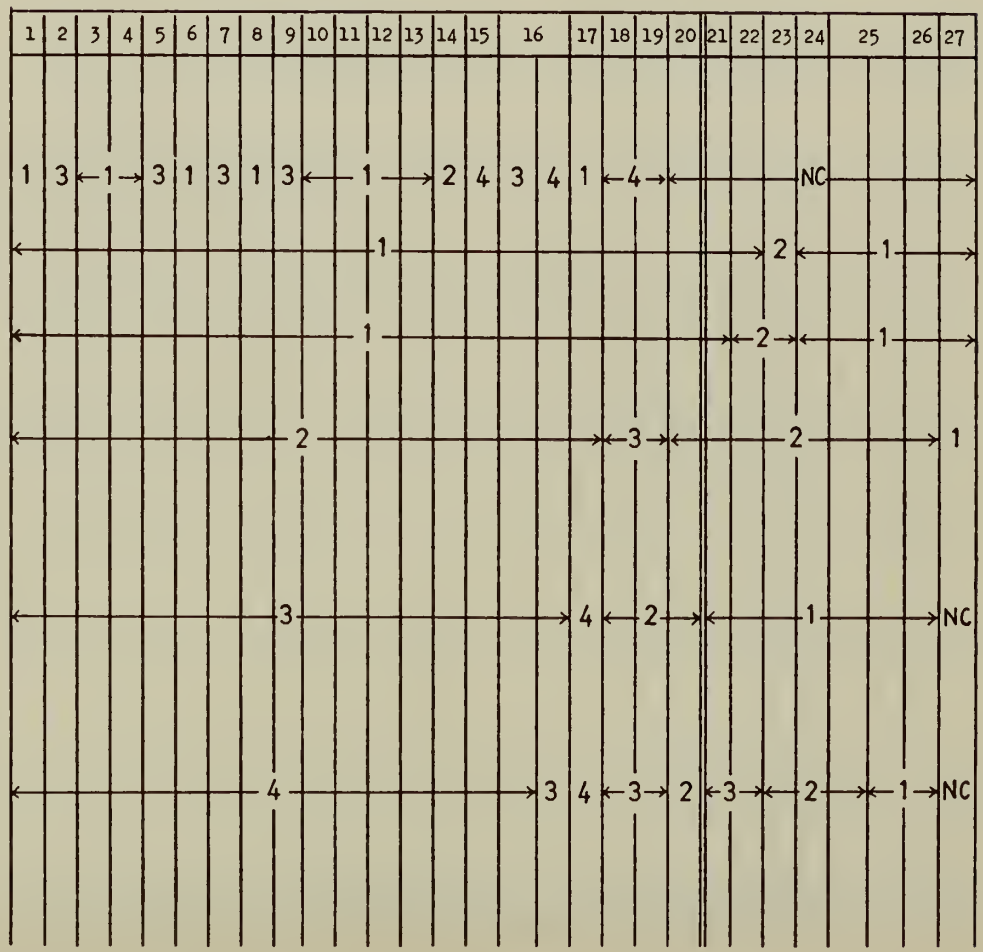
Dorsal setae of segment VIII: (1) Absent. (2) All subequal in length. (3) Include one seta (on each side), much longer than other abdominal setae.

Pleural setae of segment VIII: (1) All subequal in length. (2) Include one slightly longer seta. (3) Include one much longer seta (at least twice as long as other abdominal setae).

Ventral setae of segment VIII: (1) Absent. (2) Present or absent. (3) Usually one seta on each side. (4) More than one seta on each side.

Abdominal disc pores: (1) Absent. (2) Only on segment I. (3) On segment I and on some of segments II to VII. (4) On segments I to VII.





If present: (1) Only present laterally. (2) Laterally and also dorsally on one or more segments. (3) Laterally and also ventrally on one or more segments. (4) Laterally and also dorsally and ventrally on one or more segment.

Dorso-median transverse sclerotization of segment VIII: (1) Absent. (2) Present.

Ventral longitudinal sclerotization on each side of segment VIII: (1) Absent. (2) Present.

Glandular pouches and its setae: (1) Absent. (2) Only present on segment VIII. (3) Present on segments VII and VIII.

Glandular pouch setae of segment VIII: Include: (1) The terminal pair of tail setae only. (2) The tail setae and one about as long as the abdominal setae. (3) The tail setae and one of medium length. (4) The tail setae, two medium of unequal lengths and a short one.

Tail setae of segment VIII in relation to body length: (1) Comparatively very short (the body more than 12 times as long). (2) Short (the body 8-12 times as long). (3) Moderately long (the body 5-8 times as long). (4) Long (the body usually less than 5 times as long).

GENITAL SEGMENT:

(1) Abdominal segment IX laterovent-rally forming a penial sheath; the latter is not fused with the 9th tergite

GENITAL SEGMENT: (cont'd)
+ 10th segment and anteriorly bounded by a basal ridge on each side. Anal opening minute. (2) Same structure, with the basal ridges medially continuous. (3) Segments IX and X forming a genital capsule; the anal opening, in macropterous males comparatively large.

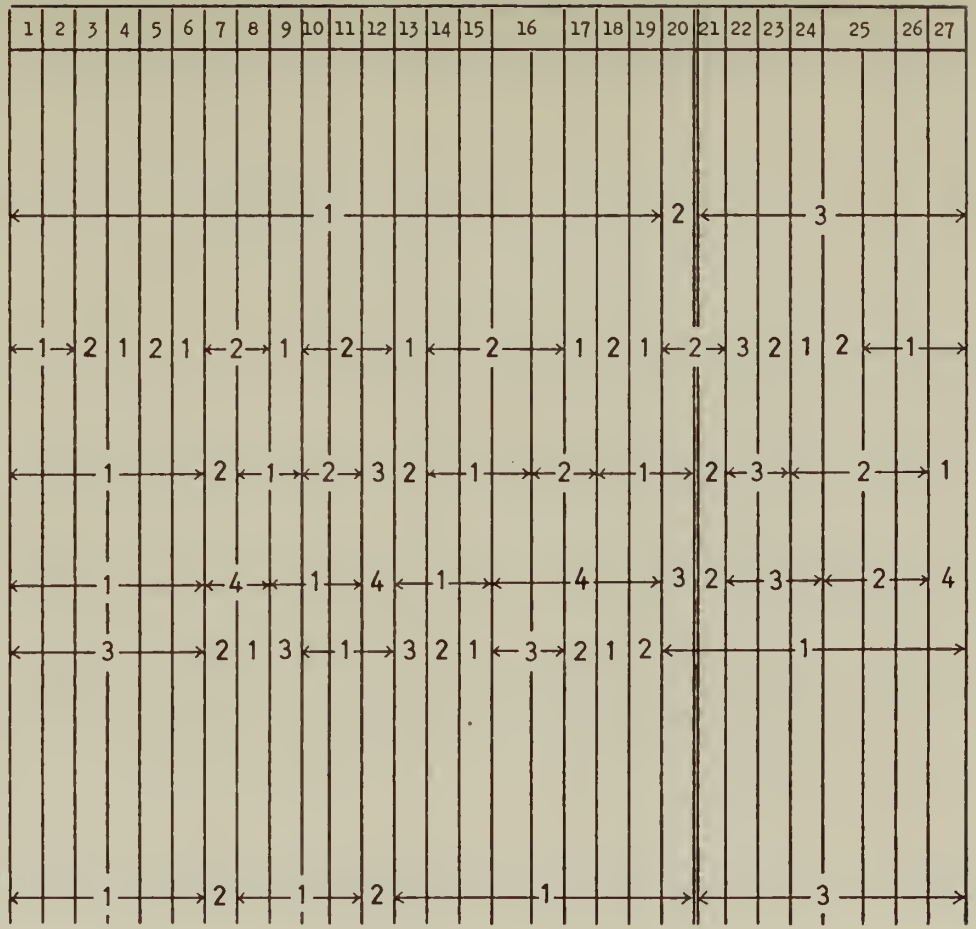
Length of the genital segment in relation to its width: (1) Length less than 1.6 times as width. (2) Length 1.6-2.1 times as width. (3) Length more than 2.1 times as width.

Length of genital segment in relation to total body length: (1) Short (the body about 9 times as long or more). (2) Intermediate. (3) Long (the body about 7½ times as long or less).

Style, in lateral view: (1) Apex curving upwards. (2) Sinuating; apex pointed. (3) Rather straight; apex pointed. (4) Rather straight; apex rounded.

Process of penial sheath: (1) Absent. Vestigial. (3) Well pronounced.

Aedeagus: (1) Arising just behind the basal ridges of the penial sheath; comparatively short. (2) Arising just behind the basal ridges of the penial sheath; comparatively long (i.e. anteriorly bent and reaching the cavity of abdominal segment VII before curving posteriorly). (3) Removed backwards and arising at a large distance from the basal ring of the genital capsule.



Dorsal setae of the genital segments on each side: (1) One seta only present. (2) 2 setae, noticeably longer than the abdominal setae. (3) 3 setae, subequal or slightly shorter than the abdominal setae. (4) More than 3 setae, subequal to the abdominal.

TABLE II: The number of characters shared by each pair of species:

138 character	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		17	18	19	20	21	22	23	24	25		26	27
1. Planococcus citri		128	120	125	110	111	108	110	101	110	105	104	104	98	103	101	83	87	73	67	74	61	57	56	56	54	37	37	36
2. " kenyae			121	122	106	106	111	107	101	114	108	105	109	100	107	99	62	87	73	70	69	63	59	60	56	56	39	38	37
3. " dioscoreae				119	106	107	108	109	101	109	105	102	102	96	104	99	60	84	72	65	67	58	54	53	48	51	31	34	35
4. Planococcoides ireneus					111	107	108	109	103	110	105	101	103	96	100	104	66	86	71	67	69	57	57	56	50	52	36	37	36
5. Nipaecoccus vastator						110	107	100	108	100	92	93	92	91	90	93	57	86	73	68	70	61	51	53	51	51	35	35	29
6. " nipae							102	99	105	97	92	91	94	89	90	88	56	83	75	72	76	57	57	52	55	52	38	38	38
7. Maconellicoccus hirsutus								103	110	109	108	107	101	100	105	91	59	61	68	65	66	59	51	57	47	51	34	33	32
8. Ferrisiana virgata									96	104	100	104	102	97	103	96	61	87	73	71	74	56	54	56	49	55	36	35	36
9. Trionymus newsteadi										98	97	98	95	97	97	84	56	81	66	68	77	53	47	51	51	47	36	37	32
10. Pseudococcus obscurus											125	117	117	108	115	90	59	89	68	64	64	57	49	63	49	52	33	36	31
11. " maritimus (type A)												117	120	112	122	87	50	86	65	61	63	55	50	61	46	52	36	37	31
12. " citriculus													120	112	116	86	53	78	62	60	63	51	49	60	44	48	29	30	28
13. " adonidum														119	116	87	51	84	60	62	63	55	49	60	51	52	37	39	28
14. " fragilis															113	83	51	75	60	64	61	46	40	49	43	42	26	28	21
15. Dysmicoccus alazon																87	50	82	65	62	63	51	49	57	46	49	32	33	29
16. Saccharicoccus sacchari																	89	79	66	56	62	48	50	45	41	48	38	37	40
" (wingless)																		44	49	47	45	36	36	32	33	36	38	36	71
17. Octococcus africanus																			79	74	65	62	66	59	65	68	51	49	41
18. Ceroputo pilosellae																				103	82	58	51	49	58	53	45	41	25
19. Centrococcus insolitus																					77	52	49	48	50	53	44	39	25
20. Nairobia bifrons																						77	71	73	80	71	58	57	43
21. Eriococcus araucariae																							118	101	108	110	93	90	58
22. " orariensis																								102	104	113	92	90	64
23. " buxi																									91	96	78	76	51
24. Oveticoccus agavium																										104	98	97	66
25. Gossyparia spuria																											110	105	63
" (Brachypterous)																												130	67
26. G. salicicola (Brachypterous)																													67
27. Pseudochermes fraxini (wingless)																													

The characters distinctly separating the macropterous males of Pseudococcidae from those of Eriococcidae are listed in the following table (A) :

TABLE A

		Pseudococcidae	Eriococcidae
(1)	*Puparia :*	Fluffy, loosely felted, with no definite posterior opening.	Compact, closely felted, flattened, permanently split along the posterior edge.
(2)	*Postoccipital ridge :*	Weak, slender, U- or V-shaped.	Strongly developed, laterally forked.
(3)	*Terminal antennal segments :*	Elongated ; more or less cylindrical.	Barrel-shaped ; the apical segment distinctly pear-shaped.
(4)	*Proepisternum :*	With the dorsal margin (and sometimes also the ventral margin) heavily sclerotized and ridge-like.	Without any ridge-like sclerotization.
(5)	*Scutellum*, in dorsal view :	Pentagonal.	Transverse, rectangular.
(6)	*Scutellar ridge :*	Absent.	Present.
(7)	*Anterior* and *posterior postalar ridges :*	Well separated.	Anteriorly joined.
(8)	*Mesopleural ridge :*	Interrupted above the coxal articulation.	Continuous above the coxal articulation.
(9)	*Trochanter :*	With the basal part longer than the distal one.	With the basal part shorter than the distal one.
(10)	*Ungual digitules :*	With acute tip.	Apically knobbed.
(11)	*Penial sheath :*	Basal part short, not fused with the 9th tergite + the 10th segment ; anterior margin of the slit-like opening close to the basal ridge.	Basal part long, fused with the 9th tergite, the 10th segment forming together cylindrical basal genital capsule ; anterior margin of the slit-like opening removed far posteriorly.
(12)	*Aedeagus :*	Arises ventrally just behind the basal ridge of the penial sheath.	Removed backwards and arises at a comparatively large distance from the basal ring of the genital capsule.

The two families can be also separated by a number of other less well defined characters (listed in table B), the taxonomic significance of which may be confirmed as more information becomes available :

Table B

		Pseudoccidae	Eriococcidae
(1)	*Tentorial bridge :*	Comparatively thin.	Rather stout.
(2)	*Three large bristles of terminal antennal segment :*	All preapical, or the dorsal one removed a greater distance from the apex.	All near the base of the segment, or only the dorsal one preapical.
(3)	*Claws :*	Rather long, slender, uniformly tapering to a pointed end.	Rather short and stout, broad at base and abruptly tapering to a pointed end.
(4)	*Dorsal setae of abdominal segment VIII :*	As long as other abdominal setae.	Include one conspicuously long seta on each side of the segment.
(5)	*Glandular pouch of abdominal segment VIII :*	With a pair of long setae and one or more much shorter ones.	With only one pair of setae.
(6)	*Dorsal setae of the genital segment :*	Three or more setae, subequal in length to the abdominal setae, occur on each side of the median line.	Two setae, much longer than the abdominal setae, are always present on each side.

There is also a number of supporting characters (listed in table C) whose presence or absence obtains in one of the two families, but whose alternative conditions occur in the other.

Table C

	Characters	Pseudococcidae	Eriococcidae
(1)	*Disc pores :*	Present, except in *Nairobia* group.	Always absent.
(2)	*Dorsal arm of the midcranial ridge :*	Detached anteriorly from other arms, except in *Ceroputo* and *Nairobia* groups.	Joined with the lateral and the ventral arms at the apex of the head.
(3)	*Pre. and post-ocular ridges :*	Joined by interocular ridge, except in *Ceroputo* and *Nairobia* groups.	Widely separated ; inter-ocular ridge absent.
(4)	*Cranial apophysis :*	Apically truncate.	Apically bifurcate, except in *E. buxi.*
(5)	*Anterior tentorial arms :*	Anteriorly fused before meeting cranial apophysis, except in *Ceroputo* and *Nairobia* groups.	Well separated throughout.
(6)	*Relative lengths of prescutum and scutum :*	Prescutum shorter than scutum, except in *Ceroputo* and *Nairobia* groups.	Prescutum 1–2 times as long as scutum.
(7)	*Median, longitudinal, membranous area of scutum :*	Present, except in *Ceroputo* and *Nairobia* groups.	Absent.
(8)	*Trochantin :*	Present, except in *Nairobia* group.	Absent.
(9)	*Metapostnotal ridge :*	Present, except in *Nairobia* group.	Absent.
(10)	*Ostioles :*	Present or absent.	Absent.

Apterous Males

This comparison between the apterous males of Pseudoccidae and Eriococcidae must be regarded as very provisional since it is based only on one representative of each family (*S. sacchari* and *P. fraxini*). They appear to indicate that some of the characters separating the macropterous males of the two families also differentiate the apterous forms ; these are the characters related to the conditions of the trochanter, claw, ungual digitules, penial sheath and aedeagus. The other characters separating the wingless males are given in the following table :

	Characters	Pseudococcidae	Eriococcidae
(1)	*Appearance in dorso-ventral view :*	Oblong.	Spindle-shaped.
(2)	*Sclerite degeneration :*	Comparatively less pronounced.	Well pronounced.
(3)	*Disc pores :*	Present.	Absent.
(4)	*Length of body/length of hind legs :*	Body less than 2·5 times as long.	Body more than 2·8 times as long.
(5)	*Length/width of hind femur :*	Length more than 3·5 times as width.	Length twice the width, or less.
(6)	*Length of tibia/length of tarsus :*	Tibia more than 1·5 times the length of tarsus.	Tibia less than 1·5 times the length of tarsus.
(7)	*Ostioles :*	Present.	Absent.
(8)	*Pleural setae of abdominal segments VI, VII* and *VIII :*	Include one comparatively long seta (more than twice as long as other abdominal setae).	Pleural and other abdominal setae subequal in length.
(9)	*Glandular pouches of segment VIII :*	Present.	Absent.

The differences between the two families will be compared with the differences separating other families of Coccoidea later (p. 74).

(B) Taxonomic Significance of the Characters

The taxonomically important characters of both Pseudococcidae and Eriococcidae (winged forms) are here discussed together, but the limited number of the available species of Eriococcidae make the significance and levels on which these characters may operate within this family more tentative than those of Pseudococcidae. These characters are also listed in tables III, V and VI (pp. 58, 69, 72).

General appearance

Although the appearance of the males does not seem to be strictly characteristic at any level, most Pseudoccidae are narrow and slender, whereas Eriococcidae are rather stout and robust ; the hairy appearance of the species will be discussed later.

Size

The size generally varies a great deal, even within the species themselves. Giliomee (1967), for example, showed that the host plant and the locality had a considerable influence on the size of *Parthenolecanium corni* (Bouche). No such host-determined differences have been found in *P. citri*, for which material from several host plants and localities was available. Some genera or species within certain genera are distinctly smaller than others (e.g. *N. nipae* is smaller than *N. vastator*). The size, therefore, seems to be of some significance at the generic and specific levels only.

Chaetotaxy

The presence or absence of fleshy setae on the various parts of the body was found of considerable importance, operating from the level of the groups of genera downwards to the species. The hairy appearance, which is generally due to the presence of the fleshy setae on the body itself, separates the *Pseudococcus* group. The complete absence of the fleshy setae also separates groups (*Nairobia*) or genera (*Centrococcus*). In *N. vastator* the fleshy setae are absent on the legs, but in *N. nipae* present.

The dermal pores

With the exception of the *Nairobia* group, the presence of the disc pores is a distinct character separating the two families studied ; they are always present in Pseudococcidae and absent in Eriococcidae. Within the former family their number and distribution also presents a wide range of variation, and can be utilized at most intrafamily levels.

Head

The general shape of the head appears to be of certain taxonomic significance at family level, but some minor details also separate some genera. In Pseudococcidae the head is triangular in dorsal view, whereas in most Eriococcidae it is more or less rounded ; in the genus *Saccharicoccus*, the head is dorso-ventrally flattened and the ventral preocular depression absent. The condition of the midcranial ridge operates at many levels ; family Eriococcidae and some pseudococcid groups (*Ceroputo* and *Nairobia*) are separated by having all the arms of the midcranial ridge joined together. The degree of development of the dorsal arm separates genera. The weak development of the lateral arms separates groups of genera (*Ceroputo* and *Nairobia*), genera (*Trionymus*) and species (*E. buxi*). The nature of the postoccipital ridge distinguishes the two studied families. The relationship between this ridge and the preocular ridge separates genera and species of Pseudococcoidae. The complete separation of the pre- and postocular ridges separates the family Eriococcidae and two groups of Pseudococcidae (*Ceroputo* and *Nairobia*). The dorsal reduction of the postocular ridge excludes the *Saccharicoccus* group. The relative size of the simple eyes is a useful character separating groups of genera, genera and species. The vestigial state of the lateral ocelli appear to be character-

istic of one group of Pseudococcidae (*Nairobia*) and one genus of Eriococcidae (*Ovaticoccus*). The apically truncate cranial apophysis separates Pseudococcidae and one species of Eriococcidae (*E. buxi*). The nature of the tentorial bridge is slender in Pseudococcidae and comparatively stout in Eriococcidae. The presence of a mouth tubercle separates the genus *Ovaticoccus*.

The head setae provide taxonomically important characters operating on supra-generic, generic and specific levels ; the presence of fleshy setae for example separates *Pseudococcus* group ; the presence of dorsal ocular setae separates genus *Dysmicoccus ;* the presence of setae between the ventral eyes excludes *E. buxi.*

The number and distribution of the head pores also separates groups of genera, genera and species of Pseudococcidae.

The antennae afford a number of systematically important characters, at all taxonomic levels from the family down to the species. The shape of the terminal antennal segments separates the two families ; the relative length of the antennae and the individual segments, and the presence and distribution of the different types of setae operates on most intrafamily levels, and the following have been utilized for this purpose : the ratio of the length of antennae to the length of the body and to the length of the hind legs ; the ratio of the length of the 3rd to the terminal segment ; the ratio of width to length of the 3rd and the preterminal segments ; the presence or absence of the fleshy, the hair-like and the apically knobbed sensory setae ; the number of setae on the scape ; the number, nature, relative lengths and position of the antennal bristles of the terminal segments.

Thorax

Prothorax

The absence of ridge-like sclerotization along the margins of the proepisternum separates the family Eriococcidae ; within Pseudococcidae the presence of this sclerotization along both dorsal and ventral margins of the propeisternum separates *Ceroputo* group of genera. The absence of the prosternal ridge excludes the *Saccharicoccus* group of genera.

Mesothorax

The shape of the prescutum separates groups of genera ; in the *Ceroputo* and *Nairobia* groups, the prescutum is triangular in dorsal view. The medio-posterior continuation of the prescutal ridges isolates the *Ceroputo* group. The shape and structure of the scutellum separates the two families. The following ratios were utilized, for their significance at family and lower levels : length to width of prescutum ; length of prescutum to length of scutum ; length to width of scutellum ; length of scutellum to length of scutum.

The conditions of the postalare and the mesopleural ridges are important characters separating the two families. The weak development of the basalare separates Eriococcidae and some groups of Pseudococcidae (*Octococcus, Ceroputo* and *Nairobia*). The presence of a large lateropleurite also separates Eriococcidae

and some groups of Pseudococcidae (*Saccharicoccus*, *Ceroputo* and *Nairobia*). The incomplete development of the marginal ridge of the basisternum eliminates *Saccharicoccus* group.

Metathorax

The absence of the suspensorial sclerites is accompanied by the absence of the hamulohalterae, and separates the genus *Ovaticoccus*. The absence of the meta-postnotal ridge is an important feature of all Eriococcidae and also the *Nairobia* group of genera of Pseudococcidae.

The number and distribution of the thoracic setae and pores provide useful characters at the generic and the specific levels.

The legs

The legs, like the antennae, afford several characters operating at all levels. The two families can be separated by different conditions of the following structures : (A) the proportion between the basal and the distal parts of the trochanter ; (B) the shape of the claw ; and (C) the nature of the ungual digitules. The relative length of legs separates groups of genera ; e.g. the *Saccharicoccus* group has comparatively short legs (the hind pair being shorter than half the length of the body). The absence of the tarsal digitules separates groups of genera (*Ceroputo* and *Nairobia*). The following characters were also found taxonomically important at the generic and specific levels : the presence of a long apical seta on the trochanter ; the ratio of width to length of the hind femora ; the ratio of the length of the femur to the length of the tibia in the fore leg.

The abdomen

The complete absence of the ostioles is characteristic of Eriococcidae, but among Pseudococcidae the degree of their development, or their absence separates groups of genera, genera and species. The number and nature of certain abdominal setae separates the different categories : the presence of a long dorsal seta on each side of segment VIII excludes Eriococcidae, and the entire absence of the dorsal setae on this segment characterizes the *Nairobia* group. The nature of the pleural setae of segment VIII, the number and distribution of the abdominal pores (within the Pseudococcidae) separates groups of genera, genera and species. Narrow areas of heavy sclerotization of abdominal segment VIII separate some species of Eriococcidae (*E. orariensis* and *E. buxi*).

The presence of two pairs of glandular pouches is a conspicuous character separating the *Ceroputo* group of genera. The number and relative length of the tail-forming setae of the glandular pouch operates at the levels of family and groups of genera.

The structure of the genital segment is an important character separating the two studied families. The number and size of the dorsal setae of the genital segment also separate families. The following characters and ratios were also found of some taxonomic significance in separating groups of genera, genera and species : the structure of the basal ridge of the penial sheath ; the relative length

to width of the penial sheath or the genital capsule ; the length of the genital segment to the total length of the body ; the shape of the style ; the presence or absence of the process of the penial sheath.

Classification of Pseudococcidae

It is apparent that the material was of necessity, rather limited and unevenly representative. Nevertheless, it was possible to obtain some interesting results concerning suprageneric classification, although this division is purely tentative and some of the proposed groups of genera may be subject to further subdivision, expansion or any other modification that future findings may demand. Careful examination of table I showed that the studied species of Pseudococcidae could be divided, on the basis of the different conditions of 58 characters, into 6 distinct groups of genera. Some of these groups contain several genera (each represented by one or more species), and the characters shared within each of these groups were taken as an indication of the suprageneric level of significance of these characters. In other instances a single genus (even if represented by one species only) was found by comparison to be distinct enough to constitute the nucleus of a separate suprageneric taxon. The six groups of genera, therefore, are not evenly represented ; one group contains six genera, two groups two genera each, and the remaining three groups consist of only one genus each. In addition, the published descriptions of *Puto yuccae* and *Rhizoecus falcifer*, though incomplete for detailed comparison with the present data, would certainly suggest two other groups of genera. The actual status and rank of all the recognized groups will be discussed later.

The 58 selected characters are listed in table III, which also shows their distribution among the groups. It will be noticed that alternative conditions of a few characters sometimes occur in the same group (thus only separating genera), but which separate the other groups. **Bold** characters indicate their exclusive conditions for a particular group of genera ; the total number of exclusive characters for each group is given at the end of the table.

Table III.

Characters separating groups of genera of Pseudococcidae

Characters	Groups					
	Plano-coccus	Pseudo-coccus	Sacchari-coccus	Octo-coccus	Cero-puto	Nairo-bia
	(1)	(2)	(3)	(4)	(5)	(6)
Disc pores : (1) Absent. (2) Present.	2	2	2	2	2	**1**
Fleshy setae : (1) Absent on the body itself. (2) Present on the head, thorax and abdomen, giving the body a distinctive hairy appearance.	1	**2**	1	1	1	1

HEAD :	(1)	(2)	(3)	(4)	(5)	(6)
Ventral preocular depression : (1) Entirely absent. (2) Well marked.	2	2	**1**	2	2	2
Appearance in front view : (1) Sub-triangular or rounded. (2) Dorso-ventrally flattened.	1	1	**2**	1	1	1
Dorsal arm of midcranial ridge : (1) Anteriorly detached from lateral and ventral arms. (2) All arms of the midcranial ridge joined.	1	1	1	1	2	2
Lateral arms of midcranial ridge : (1) Represented by weak sclerotization. (2) Well developed.	1 & 2	2	2	2	1	1
Postoccipital ridge : (1) U-shaped. (2) V-shaped.	1	1	**2**	1	1	1
Anterior development of postoccipital ridge : (1) Not reaching preocular ridges. (2) Confluent with preocular ridges.	1 & 2	1 & 2	1	1	2	2
Pre. and postocular ridges : (1) Widely separated. (2) Joined by means of the interocular ridge.	2	2	2	2	1	1
Postocular ridge : (1) Dorsally reduced. (2) Well developed.	2	2	**1**	2	2	2
Lateral ocelli : (1) Vestigial. (2) Large and well developed.	2	2	2	2	2	**1**
Anterior tentorial arms : (1) Separated. (2) Fused before merging into the cranial apophysis.	2	2	2	2	1	1
Head setae on each side : *Dorsal head setae :* (1) Usually 7 setae or less. (2) More than 7 setae.	2	2	2	**1**	2	2
Ventral ocular setae : (1) Absent. (2) Present.	1	**2**	1	1	1	1
Ventral head setae in a transverse row or band anterior to the ventral eyes : (1) Usually 5 setae or less. (2) More than 5 setae.	2	2	2	**1**	2	2
Genal setae : (1) 7 setae or less on each gena. (2) More than 7.	1	**2**	1	1	1	1
Ventral head pores : (1) Absent. (2) Present.	1	1	1	1	**2**	1
Antennae : (1) Comparatively short, the body 1·6 or more times as long. (2) Comparatively long, the body 1·5 or less times as long.	1	1	1	2	2	1

	(1)	(2)	(3)	(4)	(5)	(6)
Length of antenna in relation to length of hind leg : (1) Subequal or antenna shorter. (2) Antenna longer.	1	1	1	2	2	1
Relative length of 3rd and terminal antennal segments : (1) Segment III less than 1·5 times as long ; sometimes both subequal. (2) Segment III usually more than 1·5 times as the terminal.	1	1	1	1	**2**	1
Width of segment III related to its length : (1) Length usually 5·3 times the width or less. (2) Length more than 5·3 times the width.	1	1	1	1	**2**	1
Width of preterminal antennal segment to its length : (1) Length usually less than 3·3 times the width. (2) Length 3·3 times the width, or more.	1 & 2	1	1	2	2	2
Antennal setae : (1) Comparatively short ; less than twice as long as body setae. (2) Long ; twice as long as body setae or more.	1 & 2	1	1	1	2	1
Capitate, apically knobbed sensory setae : (1) Absent. (2) Present.	2	2	2	2	**1**	2
If present : (1) Only on segment X. (2) Few on segments III to X, but other setae more numerous. (3) On segments III to X forming the majority of the antennal setae.	1	1	1	**2**	NC	**3**
Number of hair-like setae on scape : (1) 4 setae almost always present. (2) More than 4 setae present.	1 & 2	2	2	1	1	1
THORAX :						
PROTHORAX :						
Proepisternum : (1) Dorsal margin ridge-like. (2) Dorsal and ventral margins ridge-like.	1	1	1	1	**2**	1
Prosternal ridge : (1) Its position only marked by heavy sclerotization. (2) Distinct.	2	2	**1**	2	2	2
Medial pronotal setae : (1) Usually absent. (2) Present.	2	2	2	1	1	1
Post-tergital setae : (1) Usually absent. (2) Present.	1 & 2	2	2	1	1	1
Antespiracular dorsal setae : (1) Absent. (2) Present.	2	2	2	1	1	2
Antespiracular ventral setae : (1) 1 seta on each side. (2) 2 setae.	1	1	**2**	1	1	1

	(1)	(2)	(3)	(4)	(5)	(6)
Prosternal setae : (1) 3 setae or less on each side. (2) More than 3 seta present.	1	**2**	1	1	1	1
Antespiracular dorsal pores : (1) Absent. (2) Present.	2	2	2	1	1	NC
MESOTHORAX :						
Prescutal ridges : (1) Well separated. (2) Posteriorly joined.	1	1	1	1	**2**	1
Width to length of prescutum : (1) Width less than 1·3 times the length. (2) Width 1·3 times the length, or less.	1 & 2	2	2	2	1	1
Scutum : Median longitudinal narrow membranous area : (1) Absent. (2) Present.	2	2	2	2	1	1
Relative length of prescutum and scutum : (1) Prescutum shorter. (2) Prescutum longer.	1	1	1	1	2	2
Relative length of scutellum and scutum : (1) Scutellum shorter than scutum. (2) Scutellum longer.	1	1	1	1	2	2
Basalare : (1) Comparatively weak and slender. (2) Rather stout.	2	2	2	1	1	1
Lateropleurite : (1) Comparatively narrow. (2) Large.	1	1	2	1	2	2
Trochantin : (1) Absent. (2) Present.	2	2	2	2	2	**1**
Marginal ridge of basisternum : (1) Absent. (2) Present.	2	2	**1**	2	2	2
Furca : (1) Comparatively small. (2) Well developed.	2	2	**1**	2	2	2
Postmesostigmatal setae : (1) Absent. (2) Present.	2	2	2	2	2	**1**
METATHORAX :						
Metapostnotal ridge : (1) Absent. (2) Present.	2	2	2	2	2	**1**
Alar setae : (1) Absent. (2) Present.	2	2	2	2	2	**1**
LEGS :						
Hind legs : (1) Short ; the body more than 2·2 times as long. (2) Long ; the body less than 2·2 times as long.	2	2	**1**	2	2	2
Femur : (1) Front femur shortest. (2) Middle femur shortest.	1 & 2	1	1	2	2	1
Tarsal digitules : (1) Absent. (2) Present.	2	2	2	2	1	1

	(1)	(2)	(3)	(4)	(5)	(6)
ABDOMEN :						
Ostioles : (1) Absent. (2) Present.	1 & 2	2	2	1	2	1
Dorsal setae of segment VIII : (1) Absent. (2) Present.	2	2	2	2	2	**1**
Pleural setae of segment VIII : (1) All of subequal length. (2) Include one slightly longer seta.	1 & 2	2	2	1	1	1
If disc pores present : (1) Only on segment I. (2) On segment I and other abdominal segments.	2	2	2	**1**	2	NC
Glandular pouches and their setae : (1) Only on segment VIII. (2) One set on each side of segments VII and VIII.	1	1	1	1	**2**	1
Setae of the glandular pouch of segment VIII : (1) Include a pair of comparatively long tail setae and one much shorter seta. (2) Include a pair of tail setae, two of medium, unequal lengths and a short one.	1	1	1	**2**	1	1
Length of tail setae related to total length of body : (1) Short ; body usually more than 5 times as long. (2) Long ; body usually 5 times as long, or less.	2	2	2	2	1	1
Basal ridge of the penial sheath : (1) Medially interrupted and with a small projection. (2) Medially continuous ; projection absent.	1	1	1	1	1	**2**
Total number of exclusive characters	0	4	8	5	8	9

In discussing the groups of genera, an attempt was made to assess their primitive or specialized status, on the basis of the number of shared specialized and primitive characters, but this was found to be rather difficult. Theron (1958) discussed the matter with reference to the conditions of the more primitive Sternorrhynchan Homoptera and considered 3 main conditions as distinct specializations in Coccoidea : (1) sclerite degeneration, and consequently (2) the development of secondary ridges for reinforcing the desclerotized parts, (3) the absence of any of the primary ridges, or the reduction of other generalized structures.

When the groups of genera of the studied Pseudococcidae were compared with each other, the different structures showed varying degrees of development, and complying with the principles already set out by Theron (l.c.) and Giliomee (1967), the following conditions of the various characters were regarded as specialized :

(a) *The presence of :* ocular ridges (preocular, postocular and interocular) ; ridge-like sclerotization of the proepisternum ; short and transverse scutellum ; ostioles ; basal ridge replacing the basal ridge of the penial sheath.

The presence of the lateral arms of the midcranial ridge is considered as a secondary specialization since they are absent in primitive families (Margarodidae), but reappear in most specialized ones such as Coccidae and Diaspididae.

(b) *The absence of :* various sclerites (as an expression of sclerite degeneration) ; disc pores ; dorsal and ventral arms of midcranial ridge ; lateral ocelli ; pronotal ridges ; cervical sclerites ; metapleural ridges ; hamulohalterae ; tarsal digitules ; glandular pouches and their setae.

On the other hand, the following conditions were considered as being primitive :

(a) *The strong development of :* postoccipital ridge : distinct neck region ; basalare.

(b) *The presence of :* more than 2 pairs of simple eyes ; separated anterior tentorial arms ; prosternal or metasternal apophyses ; large lateropleurites ; more than one hamulohalteral seta ; preapical denticle of the claw.

The presence of a small, narrow sclerite identified as the trochantin (first mentioned by Giliomee, 1961, and noticed but not identified as such by Makel, 1942), and found in all Pseudococcidae here studied except *N. bifrons*, should be considered as a primitive condition. It was not discussed at all by Theron, but Weber (1928) and Roberti (1946) found it in *Aphis*.

(c) *The absence of :* prosternal ridge ; marginal ridge of the basisternum ; metapostnotal ridge.

a. *Groups of genera :*

The proposed groups of Pseudococcidae are :

I. The *Nairobia* group, represented by the genus *Nairobia* only, is the most specialized among the Pseudococcidae here studied. The exclusive characters of this group are :

(1) The disc pores entirely absent.

(2) The lateral ocelli vestigial.

(3) Antennal segments III to X with a dominant number of capitate, apically knobbed sensory setae.

(4) The trochantin absent.

(5) The metapostnotal ridge absent.

(6) The basal ridges of the penial sheath ventro-medially continuous and their projections absent.

(7) The absence of the postmesostigmatal and the alar setae, and the abdominal dorsal setae of segment VIII.

The group exhibits a large number of specializations which include four of the above-listed exclusive characters (1, 2, 6 and 7) as well as : (5) the reduction of the prosternal plates, (6) the weak development of the basalare, (7) the absence of the tarsal digitules, and (8) the reduction of the setae of the glandular pouches.

It also features a few primitive conditions including : (1) the absence of the metapostnotal ridge (exclusive character No. 5), (2) the weak development of the lateral arms of the midcranial ridge, (3) the absence of the interocular ridges, (4) separated anterior tentorial arms, and (5) the absence of ostioles.

This group shares with Eriococcidae the absence of three characters typical of Pseudococcidae (i.e. the absence of : disc pores, metapostnotal ridge and trochantin), and probably represents a link between these two families.

As far as the existing literature is concerned, none of the previously described genera could be assigned to this group.

II. The *Ceroputo* group, represented by two closely related genera, *Ceroputo* and *Centrococcus*, which share between them a large number of characters (103) ; this group is less specialized than *Nairobia* and shows the following exclusive conditions :

(1) The ventral head pores present.

(2) The 3rd antennal segment $1\frac{1}{2}$ or more times as long as the terminal segment.

(3) The 3rd antennal segment more than 5·3 times as long as wide.

(4) The capitate, apically knobbed sensory setae of the antennae entirely absent.

(5) The dorsal and the ventral margins of the proepisternum heavily sclerotized and ridge-like.

(6) The prescutal ridges posteriorly continuous.

(7) The glandular pouches and their setae present on each side of abdominal segments VII and VIII.

The specializations of the group include two of the above-listed exclusive characters (5 & 6) and : (3) the presence of a ridge-like projection or sclerotized arm extending anteriorly from the postocular ridge, (4) the reduction of the scutum, (5) the weak development of the basalare, (6) the absence of the tarsal digitules, and (7) the short setae of the glandular pouches.

The primitive features are two of the exclusive characters (1 & 7) and : (3) the weak development of the lateral arms of the midcranial ridge, and (4) the separation of the anterior tentorial arms.

From the available generalized descriptions of the males of *Phenacoccus aceris* (Sign.) (Šulc, 1943), *Heterococcus graminicola* Morrison (Morrison, 1945), *Phenacoccus piceae* Loew (Jancke, 1955) and *Phenacoccus gossypii* Townsend & Ckll. (Beardsley, 1960, 1962), it appears that the genera *Phenacoccus* and *Heterococcus* also belong to this group. The descriptions indicate that all these species have glandular pouches and associated setae on each side of abdominal segments VII and VIII, which is the most distinctive exclusive character of the *Ceroputo* group of genera.

III. The *Octococcus* group is fairly specialized and represented by one genus only, *Octococcus*. Its only representative species (*O. africanus*) exhibits a number

of exclusive features justifying its isolation as a separate group. These exclusive features concern chaetotaxy and the distribution of disc pores, namely : (1) dorsal head setae 7 or less on each side ; (2) transverse band of ventral head setae include 5 or less setae on each side ; (3) few capitate, apically knobbed sensory setae present on antennal segments III to X ; (4) abdominal disc pores present on segments I and VIII only ; and (5) setae of the glandular pouch include a pair of comparatively long tail-forming setae, two setae of medium, unequal lengths and a short one.

The specializations of the group are : (1) the absence of disc pores on the head and on abdominal segments II to VII ; (2) the strong development of the lateral arms of the midcranial ridge ; and (3) the presence of interocular ridges.

The primitive features are : (1) a large scutum, (2) strong basalare, and (3) long setae of the glandular pouches.

None of the previously studied species could be included in this group.

IV. The *Saccharicoccus* group, which also comprises only one genus, *Saccharicoccus*. The species studied (*S. sacchari*) represents a rather primitive group with the following exclusive characters :

(1) The head and body dorso-ventrally flattened.

(2) The ventral preocular depression entirely absent.

(3) The postoccipital ridge V-shaped.

(4) The postocular ridge dorsally reduced.

(5) The prosternal ridge absent.

(6) The antespiracular ventral setae more than one on each side.

(7) The marginal ridge of the basisternum absent medially.

(8) The furca reduced.

(9) The legs comparatively short ; the body more than 2·2 times as long as the hind legs.

The specializations of the group are : (1) the strong development of the lateral arms of the midcranial ridge ; (2) the presence of interocular ridges ; and (3) the reduction of the furca.

The comparatively large number of primitive features include three exclusive characters (4, 5, 7) and : (4) large scutum, (5) strong basalare, (6) long setae of glandular pouches.

No other species could be assigned to the *Saccharicoccus* group.

V. The *Pseudococcus* group : Two genera, *Pseudococcus* and *Dysmicoccus* represent this group and share 93 characters. The group is one of the two most primitive among the material studied, and includes species with most characters in the generalized pseudococcid condition. It shows only one exclusive, but rather obvious character, i.e. the presence of fleshy setae on any part of the body itself (head, thorax and abdomen), usually giving the species a rather hairy appearance. The specializations of this group are : (1) lateral arms of midcranial ridge strongly developed, (2) interocular ridge present.

The primitive characters are : (1) scutum large, (2) basalare strong, (3) setae of the glandular pouches long.

The descriptions of *Pseudococcus antricolens* Ferris ; *P. dorsispinosus* Beard. ; *P. floriger* Ferris ; *P. lycopodii* Beard. ; *P. montanus* Ehrhorn ; *P. straussiae* Ehrhorn ; *P. comstocki* (Kuwana) ; *P. peleae* Beard. ; *Dysmicoccus boninensis* (Kuwana) ; *D. brevipes* (Ckll.), *D. neobrevipes* Beard. by Beardsley (1960, 1962, 1965) and those of *Pseudococcus fragilis* Brain ; *P. adonidum* (L.) ; and "*P. maritimus* (Ehrhorn) type A & B" by Giliomee (1961) show that all these species have fleshy setae on one or more parts of the body itself, thus confirming the validity of the exclusive character in the other species of the two genera *Pseudococcus* and *Dysmicoccus*. According to Beardsley (l.c.), the males of *Pedronia acanthocauda* Beard., *P. cibotii* Beard., *P. crypta* Beard., *P. hawaiiensis* Ferris, *Clavicoccus tribulus* Ferris, *Phyloccus oahuensis* (Ehrhorn), *Laminicoccus giffardi* (Ehrhorn), *Palmicola palmarum* (Ehrhorn), and *Nesococcus pipturi* (Ehrhorn) also have fleshy setae on the main parts of the body. The genera *Pedronia, Clavicoccus, Phylococcus, Laminicoccus, Palmicola* and *Nesococcus* apparently ought also to be placed in the *Pseudococcus* group of genera.

VI. The *Planococcus* group, includes the remaining genera here studied (i.e. *Planococcus, Planococcoides, Nipaecoccus, Maconellicoccus, Ferrisiana* and *Trionymus*) ; these genera also exhibit the generalized conditions of almost all characters and represent one of the most primitive groups among the material studied. Pairs of genera within the group share a rather large number of characters (88–111) and the members of the group have 71 characters in common. It may be interesting to note that this group, unlike all the others here recognized, has no exclusive characters. The two specializations of the group (i.e. strong development of the lateral arms of the midcranial ridge and the presence of interocular ridge) and the three primitive conditions (i.e. large scutum, strong basalare and long setae of glandular pouches) are the same as in the *Pseudococcus* group, and the two groups, as will be discussed, are very closely related.

Beardsley's (l.c.) descriptions of *Chorizcooccus lounsburyi* (Brain) (=*Trionymus lounsburyi* Brain), *Trionymus multiductus* Beard., *T. rostellum* Lobdell, *T. danthoniae* Morrison, *Nipaecoccus nipae* (Mask.), *N. vastator* (Mask.), *N. longispinus* Beard. and *Antonina crawii* Ckll. indicate that all these species exhibit the generalized characters of Pseudococcidae and have no fleshy setae on the body itself, thus confirming the writer's concept in including *Trionymus* and *Nipaecoccus* in the *Planococcus* group. The descriptions also suggest that *Chorizcooccus* and *Antonina** also belong to this group of genera.

Beardsley (1960) also described the males of *Trionymus refertus* Ferris and showed that they carry few fleshy setae on the head. For this reason, and to comply with the present definition of the groups, this species should be placed in *Pseudococcus* group. This would imply that it may not be congeneric with the

* The writer, in a subsequent study of 5 *Antonina* species (Afifi and Kosztarab, 1967), decided to remove the genus *Antonina* from the *Planococcus* group and assigned it to the *Saccharicoccus* group of genera.

other spp. of *Trionymus*, since the latter definitely belongs to the *Planococcus* group. In this respect it may be interesting to point out that this species was referred to *Trionymus* with some reservation, and Ferris (see Zimmerman, 1948) noted that certain characters of the females (presence of 4 conical setae in each anal lobe cerarius, complete absence of multilocular pores and very few and small tubular ducts) separate it well from any other species referred to *Trionymus*.

Other groups of Pseudococcidae

Beardsley (1962) described the males of another two rather interesting pseudococcid species, *Puto yuccae* (Coquillett) and *Rhizoecus falcifer* Kunckel d'Herculais, both of which showed great structural diversities from the usual males here discussed. It is evident, in view of these descriptions, that neither species could be accepted in any of the recognized groups, and therefore the introduction of two additional ones, *Puto* and *Rhizoecus* respectively, seems to be inevitable. It must be remembered that the identity of these groups is based purely on the available information extracted from Beardsley's paper.

VII. The *Puto* group probably represents the most primitive extreme within the Pseudococcidae. The group has the largest number of exclusive primitive characteristics, namely : (1) sclerite degeneration less pronounced ; (2) a neck region well developed ; (3) the presence of numerous disc pores ventrally on the head (about 12 on each side) ; (4) the presence of more than two pairs of simple eyes ; (5) the ventral arm of the midcranial ridge posteriorly reaching the preoral ridges, and the lateral arms absent ; (6) the presence of prosternal apophyses ; (7) the hamulohalterae usually with more than one apically hooked seta ; (8) the claw with a preapical denticle and a pair of stout spine-like projections on the inner face, near its base.

The detailed description of the males of *Puto antennatus* Sign. by Reyne (1954) indicates that this species is definitely congeneric with *P. yuccae*, with which it shares almost all the above-listed exclusive characters (the presence of prosternal apophyses was not mentioned) ; Reyne's account of the males of *Macrocerococcus superbus* Leon. and his illustration of the head (dorsal view) also suggest the inclusion of the genus *Macrocerococcus* in this group.

The primitive nature of *Puto* sp. among Pseudococcidae is also supported by cytological studies (Hughes-Schrader, 1944).

VIII. The *Rhizoecus* group : Contrary to conditions in *Puto*, this group represents the most specialized extreme of the known males of Pseudococcidae. It exhibits the largest number of exclusive specialized characteristics, which include : (1) the head broadly joined to the thorax, the neck region being absent ; (2) sclerite degeneration of the thorax more pronounced ; (3) absence of a distinct midcranial ridge ; (4) absence of the cervical sclerites ; (5) absence of the lateral ocelli ; (6) reduction of the pronotal ridges ; (7) absence of the hamulohalterae ; (8) absence of the metapleural ridge ; (9) absence of the glandular pouches.

The *Rhizoecus* group also shows the following conditions which are regarded as

primitive : (1) the absence of the preocular ridges ; (2) the presence of a pair of prosternal apophyses ; and (3) the less pronounced sclerite degeneration of the abdominal segments.

According to Hambleton (1946), the genera *Rhizoecus, Ripersiella, Geococcus* and *Pseudorthizoecus* appear to be elements of a natural group within the mealybugs, to which he also added 4 new genera : *Radicoccus* (*Radiococcus*, misspelling), *Brevicoccus, Morrisonella* and *Neorthizoecus*. This group was erected on the basis of certain female characters (geniculate antennae and nature of the anal ring) and on the fact that all these genera include ground-inhabiting species. Apart from *Rhizoecus*, no information about the males of this group is available, and it would be interesting if Hambleton's conception of this natural group could be confirmed on the basis of male characters also.

Relationships between the groups of Pseudococcidae

The relationships between the groups of genera is illustrated in table IV which shows : (1) the number of characters shared by any pair of groups ; (2) the number of characters exclusive to each of these pairs ; and (3) the number of characters by which the pairs of groups differ from each other. These affinities are based on the total number of shared characters, since the specialized or primitive condition of most of these could not be determined with great certainty.

TABLE IV

RELATIONSHIPS BETWEEN THE GROUPS OF GENERA

	Number of Characters.		
	(A)	(B)	(C)
Pairs of groups	Shared	of which exclusive	Differentiating
Planococcus—Pseudococcus	44	0	4
Planococcus—Saccharicoccus	38	0	10
Planococcus—Octococcus	37	0	11
Planococcus—Ceroputo	25	0	22
Planococcus—Nairobia	26	0	22
Pseudococcus—Saccharicoccus	42	0	14
Pseudococcus—Octococcus	36	0	21
Pseudococcus—Ceroputo	22	0	35
Pseudococcus—Nairobia	24	0	33
Saccharicoccus—Octococcus	31	0	27
Saccharicoccus—Ceroputo	18	0	39
Saccharicoccus—Nairobia	20	0	38
Octococcus—Ceroputo	32	4	25
Octococcus—Nairobia	28	0	30
Ceroputo—Nairobia	34	8	24

Examination of this table suggests that :

(a) The *Planococcus* and *Pseudococcus* groups are the closest relatives, sharing the largest number of characters (44) and differentiated by the smallest (4).

(b) *Planococcus, Pseudococcus, Saccharicoccus* and *Octococcus* groups seem to be closely related ; they exhibit the generalized typical pseudococcid condition and share a comparatively large number of characters (31–44).

(c) The *Ceroputo* group is the closest relative to *Nairobia*, and vice versa ; the two groups have the largest number of exclusive conditions (8), and share 34 characters, which is more than each of them shares with any other group.

These relationships, and taking into consideration the available published information, probably indicate that there are four major sections of Pseudococcidae :

I. The *Rhizoecus* section which represents the most specialized extreme.

II. The *Ceroputo* + *Nairobia* section which is less specialized.

III. The *Planococcus, Pseudococcus, Saccharicoccus* and *Octococcus* section, which includes closely related and rather primitive groups.

IV. The *Puto* section, which appears to represent the most primitive extreme of all.

It is difficult to ascribe any definite taxonomic status to these sections, but they may possibly deserve subfamily ranks, with further subdivision into tribes and subtribes based on the groups of genera suggested here. However, further investigations of more widely representative material is required before more accurate conclusions could be made.

b. *Genera*

In table V, 73 characters are listed, separating the genera in at least one of the three groups in which more than one genus was available. When a character can be used taxonomically within a particular group, it is marked " G " in the table ; if it holds at the specific level only or at both generic and specific levels, the marks " S " or " GS " respectively are given ; the mark " — " indicates that the character does not apply at all within the group.

TABLE V

LIST OF CHARACTERS SEPARATING GENERA

Characters	Plano-coccus group	Pseudo-coccus group	Ceroputo group
1. Presence and position of fleshy setae on body.	GS	—	G
HEAD :			
2. Nature of ventral preocular depression.	GS	—	—
3. Nature of dorsal arm of midcranial ridge.	G	—	G
4. Degree of posterior development of dorsal arm.	G	G	G
5. Nature of the lateral arms of the midcranial ridge.	G	—	—
6. Nature of the postoccipital ridge.	—	—	G
7. Condition of the postoccipital ridge anteriorly.	GS	G	—

	Characters	Plano-coccus group	Pseudo-coccus group	Ceroputo group
8.	Nature of the ventral rudiment of the preocular ridge.	G	—	—
9.	Distance between the dorsal eyes related to their corneae.	GS	—	G
10.	Relative size of dorsal and ventral eyes.	S	—	G
11.	Nature of attachment of ocellus to postocular ridge.	—	—	G
12.	Number of dorsal head setae.	G	—	—
13.	Number of genal setae.	GS	—	G
14.	Number of dorsal ocular setae.	—	G	—
15.	Presence of setae between ventral eyes.	—	—	G
16.	Number of ventral head setae, transversely arranged in front of the ventral eyes.	G	—	G
17.	Presence and position of head pores.	G	—	G
18.	Number of disc pores, if present, dorsally only on the head.	GS	GS	—
	ANTENNAE :			
19.	Relative length of antenna to body.	GS	S	—
20.	Relative length of antenna to hind leg.	GS	S	—
21.	Relative length of 3rd and terminal segments.	GS	S	—
22.	Width of segment III related to its length.	G	S	—
23.	Presence of fleshy setae on antennae.	—	—	G
24.	Relative length of antennal and body setae.	GS	—	—
25.	Number of hair-like setae on scape.	G	—	—
26.	Number of antennal bristles on terminal segment.	GS	S	G
27.	Relative length of the two lateral bristles of terminal segment to those on preceding segments.	—	—	G
28.	Relative lengths of the three large bristles of terminal segment.	G	GS	—
	THORAX :			
29.	Shape of prosternum.	GS	—	G
30.	Nature of prosternal ridge.	GS	—	—
31.	Number of medial pronotal setae.	GS	S	—
32.	Number of lateral pronotal setae.	GS	GS	—
33.	Number of post-tergital setae.	G	S	G
34.	Presence of prosternal setae.	—	—	G
35.	Number of medial pronotal pores.	GS	—	—
36.	Number of lateral pronotal pores.	—	S	G
37.	Number of antespiracular dorsal pores.	GS	S	—

	Characters	Plano-coccus group	Pseudo-coccus group	Ceroputo group
38.	Number of prosternal pores.	GS	S	—
39.	Relative length of prescutum to scutum.	—	—	G
40.	Appearance of scutellum in dorsal view.	—	—	G
41.	Presence of a membranous area on the lateropleurite.	—	—	G
42.	Number of prescutal setae.	GS	—	G
43.	Number of scutal setae.	S	S	G
44.	Number of scutellar setae.	GS	S	—
45.	Number of tegular setae.	GS	GS	G
46.	Position of postmesostigmatal setae.	G	S	—
47.	Number of postmesostigmatal pores.	G	S	G
48.	Number of metatergal setae.	GS	S	G
49.	Number of metapleural setae.	GS	S	G
50.	Number of anterior metasternal setae.	GS	S	—
51.	Number of posterior metasternal setae.	GS	S	—
52.	Presence of metatergal pores.	G	S	—
53.	Presence of metaspiracular pores.	GS	S	—
54.	Presence of anterior metasternal pores.	GS	S	—
55.	Presence of posterior metasternal setae.	GS	S	—
56.	Number of alar setae.	GS	GS	G
57.	Number of circular sensoria on fore wings.	G	S	—
58.	Relative length of the hamulohalteral seta to length of the hamulohaltera.	G	—	G
59.	Relative length of fore legs.	G	—	—
60.	Presence of differentiated apical seta on trochanter.	GS	—	—
61.	Relative length of fore and middle femora.	GS	S	—
62.	Relative width of hind femur to its length.	G	—	G
63.	Relative lengths of tibia and femur in fore legs.	G	—	—
	ABDOMEN :			
64.	Nature of ostioles.	GS	S	G
65.	Number of ventral setae on abdominal segment VIII.	GS	S	—
66.	Presence of disc pores on abdominal segments.	G	S	—
67.	Position of abdominal pores.	GS	GS	—
68.	Relative length to width of penial sheath.	GS	S	G
69.	Relative length of genital segment to total length of body.	G	S	—
70.	Appearance of style in lateral view.	G	S	—
71.	Condition of process of penial sheath.	G	S	G

Characters	Plano-coccus group	Psendo-coccus group	Ceroputo group
72. Comparative length of aedeagus.	G	S	—
73. Number of dorsal setae of the genital segment.	—	—	G

c. *Species*

Table VI includes 57 characters separating the species in at least one of the three genera in which more than one species was available for study. The characters operating taxonomically within a particular genus are indicated by the mark " × ", and those not operating by the mark " ○ ". The table shows that the species of these genera could be separated by a large number of characters including differences in the development of various structures, the number and distribution of the setae and disc pores.

TABLE VI

LIST OF CHARACTERS SEPARATING SPECIES

Characters	Plano-coccus	Nipae-coccus	Pseudo-coccus
1. Presence of fleshy setae on antennae and legs.	○	×	○
HEAD :			
2. Nature of ventral preocular depression.	×	○	○
3. Anterior development of postoccipital ridge.	×	○	○
4. Distance between dorsal eyes in relation to diameter of their corneae.	×	×	○
5. Relative size of dorsal and ventral eyes.	○	×	○
6. Number of genal setae.	○	×	○
7. Number of head pores.	×	○	×
ANTENNAE :			
8. Relative length to body.	×	○	×
9. Relative length to hind legs.	○	×	×
10. Relative lengths of 3rd and terminal segments.	×	○	×
11. Width of segment III related to its length.	○	○	×
12. Relative length of antennal and body setae.	○	×	○
13. Number of antennal bristles of terminal segment.	○	×	×
14. Relative size of the three large bristles on terminal segment to other setae.	○	×	○
15. Relative lengths of the three large bristles of the terminal segment.	○	○	×
16. Position of the dorsal bristle of terminal segment.	○	×	○
THORAX :			
17. Shape of prosternum.	○	×	○
18. Nature of prosternal ridge.	×	○	○

	Characters	Plano-coccus	Nipae-coccus	Pseudo-coccus
19.	Number of medial pronotal setae.	○	×	×
20.	Number of lateral pronotal setae.	×	×	×
21.	Number of post-tergital setae.	○	○	×
22.	Number of antespiracular dorsal setae.	○	○	×
23.	Number of antespiracular ventral setae.	○	○	×
24.	Number of medial pronotal pores.	×	×	○
25.	Number of lateral pronotal pores.	○	○	×
26.	Presence of post-tergital pores.	×	×	○
27.	Number of antespiracular dorsal pores.	×	○	×
28.	Number of prosternal pores.	○	×	×
29.	Relative length of prescutum to its width.	○	×	○
30.	Number of prescutal setae.	×	○	○
31.	Number of scutal setae.	○	×	×
32.	Number of scutellar setae.	○	×	×
33.	Number of tegular setae.	○	×	×
34.	Position of postmesostigmatal setae.	○	○	×
35.	Number of postmesostigmatal pores.	○	○	×
36.	Number of metatergal setae.	×	×	×
37.	Number of metapleural setae.	○	×	×
38.	Number of anterior metasternal setae.	×	×	×
39.	Presence of postmetastigmatal setae.	○	○	×
40.	Number of posterior metasternal setae.	×	×	×
41.	Presence of metatergal pores.	○	○	×
42.	Presence of metaspiracular pores.	×	×	×
43.	Presence of anterior metasternal pores.	×	○	×
44.	Presence of posterior metasternal setae.	×	○	×
45.	Number of alar setae.	×	○	×
46.	Number of circular sensoria on fore wings.	○	○	×
47.	Presence of apical setae on trochanter.	○	×	○
48.	Relative lengths of fore and middle femora.	×	○	×
	ABDOMEN :			
49.	Nature of ostioles.	○	×	×
50.	Number of ventral setae on abdominal segment VIII.	×	○	×
51.	Presence of disc pores on abdominal segments.	○	○	×
52.	Position of abdominal pores.	×	×	×
53.	Relative length to width of the penial sheath.	×	×	×
54.	Relative length of genital segment to total length of body.	○	○	×
55.	Lateral appearance of style.	○	○	×
56.	Condition of process of penial sheath.	○	○	×
57.	Comparative length of aedeagus.	○	○	×

Eriococcidae

A division of this family into groups of genera, similar to that of Pseudococcidae could be suggested at the present stage. Only 7 species (representing 4 genera) belonging to this family were available, and it was not possible to assess correctly the significance of the morphological differences they exhibit. However, the distribution of the body setae and the structure of the genital segment appear to be most significant. Inspection of table II shows that of the 3 spp. of *Eriococcus*, *E. araucariae* shares a comparatively large number of characters with *E. orariensis* (118), but each has only 101 and 102 characters respectively, in common with *E. buxi*. This would suggest that the latter is less closely related to the other two species and would support Borchsenius's (1963) view that *E. buxi* (the type species of *Eriococcus*) is not congeneric with the other species hitherto ascribed to the same genus.

On the other hand, the structure of the genital capsule indicates that the studied species could be grouped as follows :

a. *E. araucariae* and *Gossyparia* spp., where the style is undulated and the base of the aedeagus distinctly sclerotized latero-dorsally.

b. *E. buxi*, *O. agavium* and *P. fraxini*, where the genital capsule is comparatively short and the style rather straight.

c. *E. orariensis*, where the genital capsule is comparatively elongate (its length more than 2·5 times its width).

It should be emphasized, however, that the available material was quite inadequate and the above suggestions are very tentative indeed.

The genera and available species of family Eriococcidae are merely separated by differences in chaetotaxy and the development of certain structures. These are listed in table I and will be used in the keys.

Relationships of Pseudococcidae and Eriococcidae with other Coccoidea

According to Balachowsky's (1937, 1942) original designation, margaroids—the most primitive type of Coccoidea males, comprise Ortheziidae and Margarodidae (including the aberrant species *Steingelia gorodetskia*) ; lecanoids comprise all the other families (including the monotypic family Phenacoleachiidae), except Diaspididae and Phoenicococcidae, which constituted the diaspidoids. Balachowsky stressed that the diaspidoids represent a homogenous group fundamentally differing in the characters of the males and females from the other two groups. Theron (1958), who gave a detailed list of morphological characters separating the three types of males, and later also Giliomee (1961, 1967), both concluded, however, that although the lecanoids are more specialized than the margaroids and less than the diaspidoids, they are nevertheless more closely related to diaspidoids than to margaroids.

As far as the relationships of Phenacoleachiidae with other coccid families are concerned, Morrison and Morrison (1922) maintained that the sole species of this family, *Phenacoleachia zealandica* (Maskell) has a number of characteristics of

Pseudococcidae " e.g. the kinds of pores, the character of the anal ring ", and other characteristics of Margarodidae " e.g. the number of antennal segments, the absence of differentiated tarsal digitules ". At the same time it has certain characters refuting any relationship with either of these families " e.g. absence of dorsal ostioles disclaiming relationship with Pseudococcidae, and presence of anal ring with setae and pores and absence of abdominal spiracles, disclaiming affinity with Margarodidae". As already mentioned, Balachowsky included the Phenacoleachiidae in the lecanoids (although admitting affinity to the margaroids mainly by the possession of 11-segmented antennae). Theron (1962), however, after detailed study of the males concluded that *Phenacoleachia zealandica* " ostensibly belongs to the margaroid group ", showing a particularly close relationship to the aberrant margaroid *Steingelia gorodetskia*. He regarded them as annectant genera linking the primitive Margarodidae with the more specialized lecanoids. Giliomee (1967), on the basis of a simple numerical analysis of the characters available for comparison, was able to demonstrate that *Steingelia* apparently represents a link between Margarodidae and Coccidae, while *Phenacoleachia* a similar link between Margarodidae and Pseudococcidae. This suggestion was strongly supported by the recent discovery and description by Beardsley (1964) of the new second *Phenacoleachia* species, *P. australis* from Campbell Islands, which shows the presence of such pseudococcid features as " ostioles and cellular anal ring ". These features tempted Beardsley to suggest that the Phenacoleachiidae are definitely allied to the mealybugs and probably represent a primitive subfamily of Pseudococcidae. The males (apterous) also described by Beardsley, have two very distinctive pseudococcid characters (as shown in the present work), i.e. the presence of disc pores and of dorsal ostioles.

The study of males has therefore revealed that there appear to be at least two links between the primitive margaroids and the more specialized lecanoids. On the other hand, a close relationship between Asterolecaniidae (lecanoid) and diaspidoids was recently suggested on the basis of cytological studies and of some characters of the female (Brown & McKenzie, 1962). Thus there may exist similar links between lecanoids and diaspidoids. There is no detailed information about the males of Asterolecaniidae,* but their study may perhaps also support this suggestion.

Theron (1958), Ghauri (1962) and Giliomee (1967) each discussed the relationships of various groups of Coccoidea based on their own observations and on the information then available. Each contribution naturally allowed for more detailed and comprehensive comparisons and conclusions. For the present author, Giliomee's conclusions are of particular interest since he was dealing with the lecanoids, and included in his discussion not only Coccidae (the main object of his studies) but also males of 3 species of Pseudococcidae described in detail in his earlier paper (1961). Incidentally, his data on these species have been included here in the tables, calculations and discussion. Giliomee pointed out that the Coccidae are more

* The males of an asterolecaniid (*Cerococcus deklei* Kosztarab and Vest) were later available to the author. They completely agreed with the lecanoid type of males, as will be shown in a separate publication.

specialized than Pseudococcidae since they generally share more characters with the highly specialized Diaspididae. Dealing with lecanoids, Giliomee found it necessary to introduce minor amendments to Theron's definition of the lecanoid type of male (these include the presence of the metasternal plates and the abdominal sclerites). The present study of Pseudococcidae and Eriococcidae has also revealed that two further minor amendments are necessary, i.e. regarding the presence of a distinct postoccipital ridge and of the metasternal apophyses.

In an attempt to determine the affinities of Coccoidea, it is now possible to consider 6 families for which adequate information on the males is now available, i.e. Margarodidae, Phenacoleachiidae, Pseudococcidae, Eriococcidae, Coccidae and Diaspididae. *Steingelia*, although a margarodid, is treated separately because of its aberrant characters. Thirteen available characters were relevant for this purpose, and the distribution of their conditions within the families is shown in table VI. Each of the characters occur either in a specialized condition (marked " × ") or a primitive one (marked " O ").

TABLE VI

MALE CHARACTERS WHOSE CONDITIONS INDICATE AFFINITIES WITHIN COCCOIDEA

	Margarodidae	Steingelia	Phenacoleachiidae	Pseudococcidae	Eriococcidae	Coccidae	Diaspididae
Specialized conditions of the characters (×) :							
1. Disc pores absent.	O	O	× O	× O	×	× O	×
2. Neck region absent.	O	O	O	O	O	O	×
3. Postoccipital ridge absent.	O	×	O	O	O	×	O
4. Interocular ridges present.	O	O	O	× O	O	× O	O
5. Tentorium absent.	O	O	O	O	O	O	×
6. Compound eyes absent.	O	×	×	×	×	×	×
7. Membraneous area of scutum absent.	× O	O	×	×	×	O	×
8. Scutellum short and transverse.	O	×	O	O	×	×	×
9. Median ridge of basisternum absent.	O	O	×	×	×	O	O
10. Metasternal sclerites absent.	O	O	O	×	×	O	O
11. Metasternal apophysis absent.	O	O	O	O	O	×	×
12. Ostioles present.	O	O	× O	× O	O	O	O
13. Penial sheath elongate.	O	O	O	O	O	×	×
Specialized conditions.	—	3	3	4	6	5	8
Primitive conditions.	12	10	8	6	7	6	5
Both conditions present.	1	—	2	3	—	2	—

It should be noted that both conditions may obtain in certain families. At the bottom of the table are given the total number of occasions on which the specialized, primitive, and both conditions occur in each group. The proportion of the number of primitive to specialized conditions of the characters can be taken as indication to the primitive or specialized nature of the group, e.g. the primitive Margarodidae have no specializations, 12 primitive characters and one in which both conditions occur, and the specialized Diaspididae show 8 specializations and 5 primitive conditions. Table VIA, prepared in the form of two half matrices, in which are given the total number of characters shared by each pair of groups (upper triangle of the matrix), and separating each pair (lower triangle). In this table the characters which occur in both conditions in either member of a pair are omitted, e.g. between Margarodidae and *Steingelia*, the character 7 in table VI (membranous area of scutum) which may be present or absent in Margarodidae, was not taken into consideration, and therefore only 12 characters are left for comparison.

TABLE VIA

The number of characters shared by, and separating each pair of families:

Sharing / Separating	Margarodidae	Steingelia	Phenacoleachiidae	Pseudococcidae	Eriococcidae	Coccidae	Diaspididae
Margarodidae		9	8	6	7	5	5
Steingelia	3		7	5	8	9	6
Phenacoleachiidae	2	4		9	9	4	5
Pseudococcidae	3	5	1		9	3	3
Eriococcidae	5	5	2	1		5	7
Coccidae	5	2	6	7	6		7
Diaspididae	7	7	6	7	6	4	

It appears from these tables that the Eriococcidae are more specialized than the Pseudococcidae. They have 6 specializations (Table VI) and share a total number of 7 characters with the decisively more specialized Diaspididae (Table VIA), while the Pseudococcidae have only 4 specialized conditions and share only 3 characters with Diaspididae. It is also interesting to note that the structure of the genital segment suggests a closer relationship between Eriococcidae and Diaspididae than between the latter and Pseudococcidae.

From the same tables it appears that Giliomee was justified in assuming that the Coccidae are more specialized than Pseudococcidae. They have 5 specialized and 6 primitive features against 4 specialized and also 6 primitive in the latter, and comparison with Diaspididae shows that they share a total number of 7 characters with Coccidae but only 3 with Pseudococcidae.

Table VIA also indicates that Coccidae are closer to Eriococcidae (sharing 5 characters) than they are to Pseudococcidae (sharing only 3 characters). In the same way it also appears that the Eriococcidae are more closely related to the Pseudococcidae (sharing 9 characters) than they are to the Coccidae (sharing only 5 characters).

Table VIB is also derived from table VI and prepared in the form of a matrix. Here the relationships between the groups are expressed in fractions obtained by dividing the number of shared conditions by the total number of characters considered. Those characters occurring in either specialized or primitive conditions were counted as 1 unit, and if both conditions occurred in any of the compared

TABLE VIB

	Steingelia	Phenaco-leachiidae	Pseudo-coccidae	Erio-coccidae	Coccidae	Diaspi-didae
Margarodidae	(0·73)	(0·73)	(0·62)	(0·58)	(0·50)	(0·42)
Steingelia		(0·62)	(0·50)	(0·62)	(0·77)	(0·46)
Phenacoleachiidae			(0·88)	(0·77)	(0·46)	(0·46)
Pseudococcidae				(0·81)	(0·42)	(0·35)
Eriococcidae					(0·46)	(0·54)
Coccidae						(0·62)
Diaspididae						

groups, they were both given a score of $\frac{1}{2}$ unit each, e.g. Margarodidae and *Steingelia* share 9 characters and are separated by 3, but in the former there is one character (No. 7) occurring in both conditions ; the numbers thus corrected will be $9\frac{1}{2}$ shared and $3\frac{1}{2}$ separating. The number of the shared characters ($9\frac{1}{2}$) was divided by the total number of characters (13) and the result (0·73) was entered in the table as a measure of similarity. The values obtained vary from 0–1 indicating no or complete similarity respectively, i.e. the higher the values are, the closer the relationship is.

From this table it is obvious that *Steingelia* and Phenacoleachiidae are similarly related to Margarodidae, and are closer to it than they are to each other. It is also apparent that Phenacoleachiidae are more closely related to Pseudococcidae than they are to Margarodidae, which would support the views of Beardsley. It also appears that *Steingelia* is closer to Coccidae than to the Margarodidae.

Giliomee (1964) discussed the taxonomic status of the family Kermococcidae, which Ferris (1937) placed in the family Eriococcidae, but which Balachowsky (1942) included as a subfamily in one family (Eriococcidae) together with Pseudococcinae

and Eriococcinae. The description of the males of *Kermococcus quercus* (L.) by Borchsenius (1960) prompted Giliomee to assume that Kermococcidae are more closely related to Coccidae than to any other Coccoidea, on the basis of 6 characters shared by the two families. Further investigations on Kermococcidae are required before Giliomee's assumption can be supported since it was based on one species only, and since the present study revealed that some of the characters he used are also shared by Pseudococcidae (separate pre- and postocular ridges) and Eriococcidae (separate ocular ridges ; short and transverse scutellum).

ANALYSIS

On the suggestion of Dr. K. Boratynski, advantage was taken of the computing facilities (IBM 7090 computer) available at Imperial College, and the data obtained in this study (138 characters for 29 species) were subjected to the more elaborate statistical analysis by some methods of numerical taxonomy. In their book on the subject, Sokal and Sneath (1963, p. VIII) define the numerical taxonomy as "the evaluation by numerical methods of the affinity or similarity between taxonomic units and the employment of these affinities in erecting a hierarchic order of taxa " ; it " aims to develop methods which are objective and repeatable both in evaluation of taxonomic affinity and in the erection of taxa ". They pointed out that assessment of the degrees of affinity of the taxa (expressed as a coefficient of similarity) should be based on a large number of characters (at least 60) to assure objectivity and repeatability. All these characters should be treated as of equal taxonomic value and the equivalence of all the characters is one of the basic assertions of numerical taxonomy. The relationships between taxa thus calculated is " phenetic ", i.e. based on overall resemblance and is free of subjective phylogenetic speculation. But the authors believe that numerical methods may open up a wide field in the exact measurement of evolutionary rates and may provide a more critical approach to phylogenetic problems (pp. VIII, 57 and chapter 8).

Method

The method employed in the main part of this thesis contains also an element of objectivity in the fact that all the characters were treated as being equivalent ; the assessment of the degree of similarity was based on simple counting of the characters shared by each pair of species. But this method does not take into consideration which of the characters are shared by various species ; moreover, a certain amount of subjective selection of characters was used in the grouping of taxa. For example, the separation of *Planococcus* and *Pseudococcus* groups of genera was based on one exclusive character, i.e. the absence or presence of fleshy setae on the main parts of the body.

The comparison of these results with those obtained by more accurate calculation of coefficient of similarity between each pair of species, was thought to be of interest.

It should be pointed out that the application of numerical taxonomy is still in an experimental stage, and the exact value of the various suggested methods for

satisfactory classification is to be investigated further. A number of papers have been published, in which numerical taxonomy was utilized. In Entomology it was applied by Stroud (1953) for Termites ; Sokal (1958) and Sokal and Michener (1958) for the classification of *Hoplitis* complex of Bees ; Rohlf (1963) for Mosquitoes ; and Sheals (1964) for Acarina.

The computer programmes were available for two methods of statistical analysis, which were used for my data :

The Principal Component (vector analysis) method, using the BIGMAT programme developed by M. Elson and R. E. Funderlic of Central Data Processing Facility, Oak Ridge, Tennessee, U.S.A., and available at the Imperial College computer unit (Share pamphlet). This programme generates first a Covariance matrix calculated from

$$\sum_{i=1}^{N} (X_{ij} - \bar{X}_j)(X_{ih} - \bar{X}_h)$$

which basically is a coefficient of similarity ; and then the subroutine BIGMAT Fortran IV matrix eigensystem solver calculates eigenvalues (latent roots) and eigenvectors (latent vectors) of real symmetric matrices and can operate up to a matric limit of 235 × 235. The " normal " analysis (Q-technique) which ordinates the species (OTU's) was used.

The Taxon analysis method as described by Sokal and Sneath (1963, p. 195 and 296), with clustering by the weighted pair-group method using Spearman's sums of variables method (WPGM) (p. 309). This method uses the correlation coefficients between each pair of OTU's based on standardized characters and calculated by the computational formula :

$$r_{jk} = \frac{\sum_{i=1}^{n} X_{ij} X_{ik} - \frac{1}{n}\left(\sum_{i=1}^{n} X_{ij}\right)\left(\sum_{i=1}^{n} X_{ik}\right)}{\left\{\left[\sum_{i=1}^{n} X_{ij}^2 - \frac{1}{n}\left(\sum_{i=1}^{n} X_{ij}\right)^2\right]\left[\sum_{i=1}^{n} X_{ik}^2 - \frac{1}{n}\left(\sum_{i=1}^{n} X_{ik}\right)^2\right]\right\}^{\frac{1}{2}}}$$

This programme was developed in the Department of Zoology, Imperial College, by Dr. G. Murdie specially for the purpose of these studies. The author, who is not very familiar with the statistical methods involved, is grateful to Dr. Boratynski for his guidance and to Dr. Murdie for developing the Taxon programme.

The method based on taxonomic distance coefficient, which in some cases was shown to give better results, could not be applied since the appropriate computer programme was not ready in time.

Procedure

The 29 species included in this study are listed on the right side of the dendogram of Fig. (A), and the order or numbering corresponds to the degree of relationships and the classification suggested by the analysis in the main part of this thesis. Family Pseudococcidae include the first 21 species and family Eriococcidae species

22–29. Species 1–9 = *Planococcus* group of genera ; species 10–15 = *Pseudococcus* group ; species 16 and 17 = *Saccharicoccus* group ; species 18 = *Octococcus* group ; species 19 and 20 = *Ceroputo* group, and species 21 = *Nairobia* group.

The 138 characters taken into consideration are the same as those listed in table I (see Discussion, p. 31). Their different state conditions were expressed in numerical code ranging from 1 to 5, but in most cases only 2–3 conditions were used. The better the structure is developed the higher the value given, e.g. the absence of a certain ridge was given 1, its weak development 2 and its strong development 3 ; if the absence of setae or pores on a particular part of the body was given the value of 1, the presence of 1–3 setae was given 2, and 4–6 for example will be 3, and 6–10 will be 4 ; the small size (e.g. body) was given 1, intermediate 2, and large 3. These conditions were punched on to the cards for processing on the IBM 7090 Fortran IV electronic computer available at Imperial College.

In the Principal Component method, the computer generates covariance matrix but prints only the diagonal values, the sum of which (Trace) represents the amount of total variance (Text-fig. I). Example of Pseudococcidae above.

The BIGMAT calculates any desired number of latent roots (eigenvalues) and the corresponding latent vectors (eigenvectors) ; as usual 10 were calculated, but only the first three were used for plotting (Text-fig. II).

Each latent root represents an axis which is perpendicular to all the other axes, and the latent vectors represent the co-ordinates on these axes, thus locating the species in the N-multiple superspace. The value of the latent root, expressed as a percentage of the sum of diagonal values, gives the amount of variance (Trace) accounted by each root. This amount is the highest for the first root and gradually decreasing in the other roots. The first three in this case (29·41%, 15·96% and 11·33%, respectively) account for 56·7% of total variance, and these were used for plotting (the remaining 7 roots account for 6·71%, 6·12%, 5·27%, 3·89%, 3·70%, 3·40% and 2·87%, respectively). The values of the co-ordinates are calculated by multiplying the eigenvalues by the square root of the corresponding latent root of each species. For the purpose of plotting an integral number was added to the latent vectors of each latent root to eliminate negative values, and in this case 6, 5 and 6, respectively were added to the three roots. Table 1 shows the data for the pseudococcid species prepared for plotting.

The 3-dimensional block diagrams of the first three vectors were made separately for (1) all forms of Pseudococcidae and Eriococcidae studied, (2) Pseudococcidae and Eriococcidae excluding the apterous males, and (3) Pseudococcidae only (Figs. 1, 2 and 3, respectively). In these diagrams the space was divided by horizontal planes. The first vector (axis) was represented by one side of the square base (horizontal, I in Figures), the third by the other side (III, oblique in the Figures), and the second vector by the vertical axis (II). For the purpose of easier reference to the actual location of the species, each side of the base (and other planes) was divided into 3 sections marked A, B, C for axis I, and a, b, c for axis III. The resulting 9 squares are defined by the reference to the appropriate sections on the

22.592		
24.392		
38.492		
24.992		
34.292		
54.492		
28.892		
45.092		
37.992		
25.792		
33.592		
46.692		
52.092		
54.292		
44.592		
54.392		
73.592		
95.592		
101.792		
123.492		
210	1017.14	Total variance (Trace)

TEXT-FIG. I. Trace of 20 spp. of Pseudococcidae.

EIGENVECTOR CORRESPONDING TO 2.9913983E 02 (= Latent root)

2.4015854E-02	7.8226104E-03	-1.2951852E-03	-3.5644727E-02	5.6835338E-02	1.2530954E-01	-5.9564865E-02	7.6450016E-03
1.0492194E-02	-1.5792798E-01	-2.2388528E-01	-2.6562484E-01	-3.1658460E-01	-3.1533943E-01	-2.4942465E-01	-8.2955210E-02
2.9370538E-01	4.4043477E-01	3.1838629E-01	4.2360780E-01				

EIGENVECTOR CORRESPONDING TO 1.6239042E 02

-2.2098002E-01	-2.3159923E-01	-3.0908342E-01	-2.7586103E-01	-2.8919946E-01	-3.6976436E-01	-1.2965085E-01	1.3466497E-01
-1.5214205E-01	1.3926755E-02	1.6055679E-01	1.9671679E-01	2.3084065E-01	2.2135791E-01	1.9066565E-01	-2.0218696E-02
3.1300302E-02	1.8158900E-01	2.5952574E-01	3.7738265E-01				

EIGENVECTOR CORRESPONDING TO 1.1523669E 02

-7.8359791E-02	5.4741075E-02	8.2461756E-02	-9.1954241E-02	1.5312027E-02	-4.1155443E-03	4.8177828E-02	-3.4256143E-01
1.0589229E-01	7.5402325E-02	1.6064501E-02	4.6854463E-02	1.3160295E-02	1.0158375E-01	-1.1463530E-02	-2.1068075E-01
-2.5461197E-01	2.7366196E-01	6.4068813E-01	-4.8076832E-01				

TEXT-FIG. II. Latent vectors corresponding to first three latent roots for 20 spp. of Pseudococcidae. The actual values of the co-ordinates for plotting are calculated by multiplying each eigenvector by the square root of the corresponding latent root.

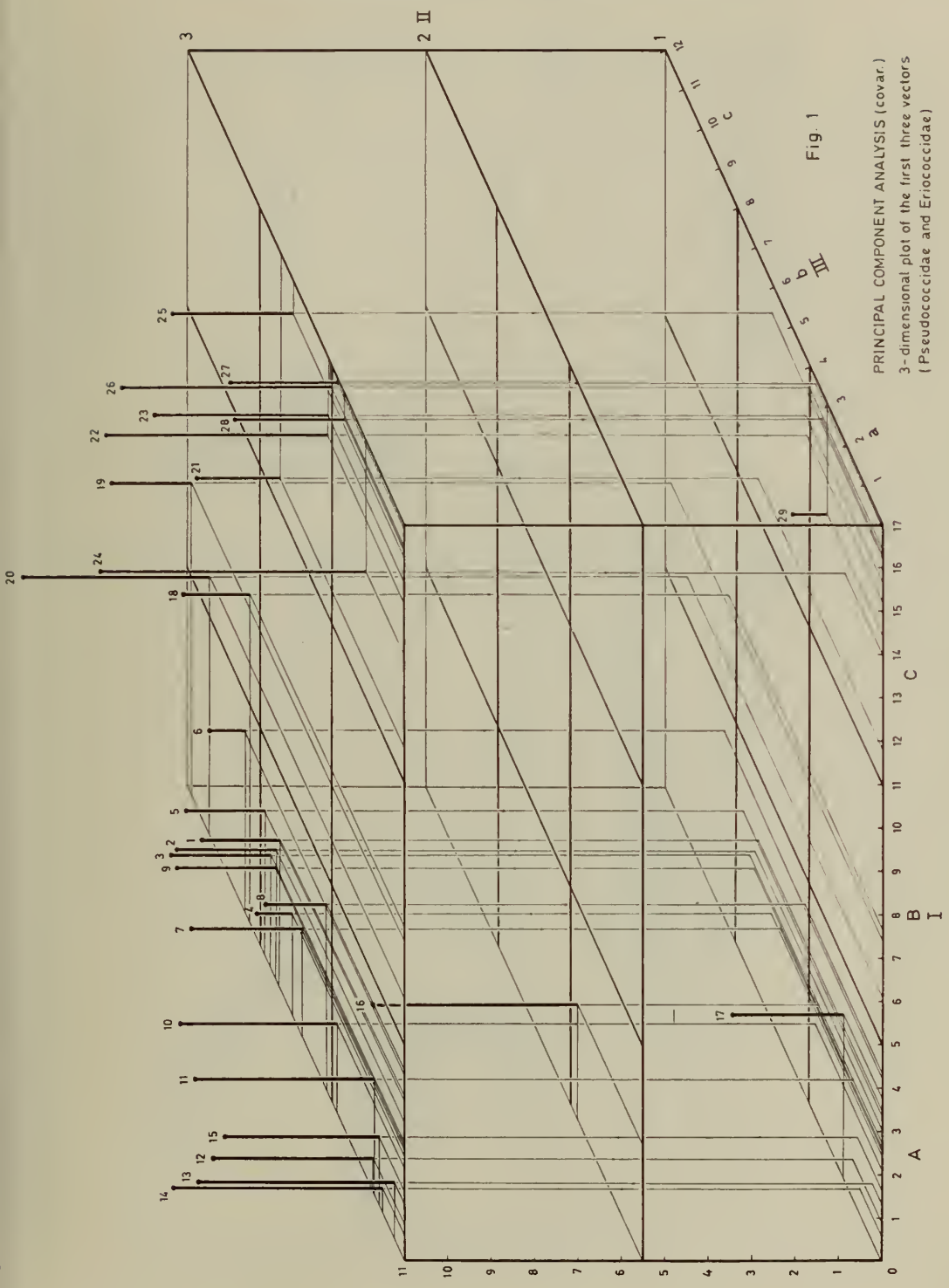


Fig. 1

PRINCIPAL COMPONENT ANALYSIS (covar.)
3-dimensional plot of the first three vectors
(Pseudococcidae and Eriococcidae)

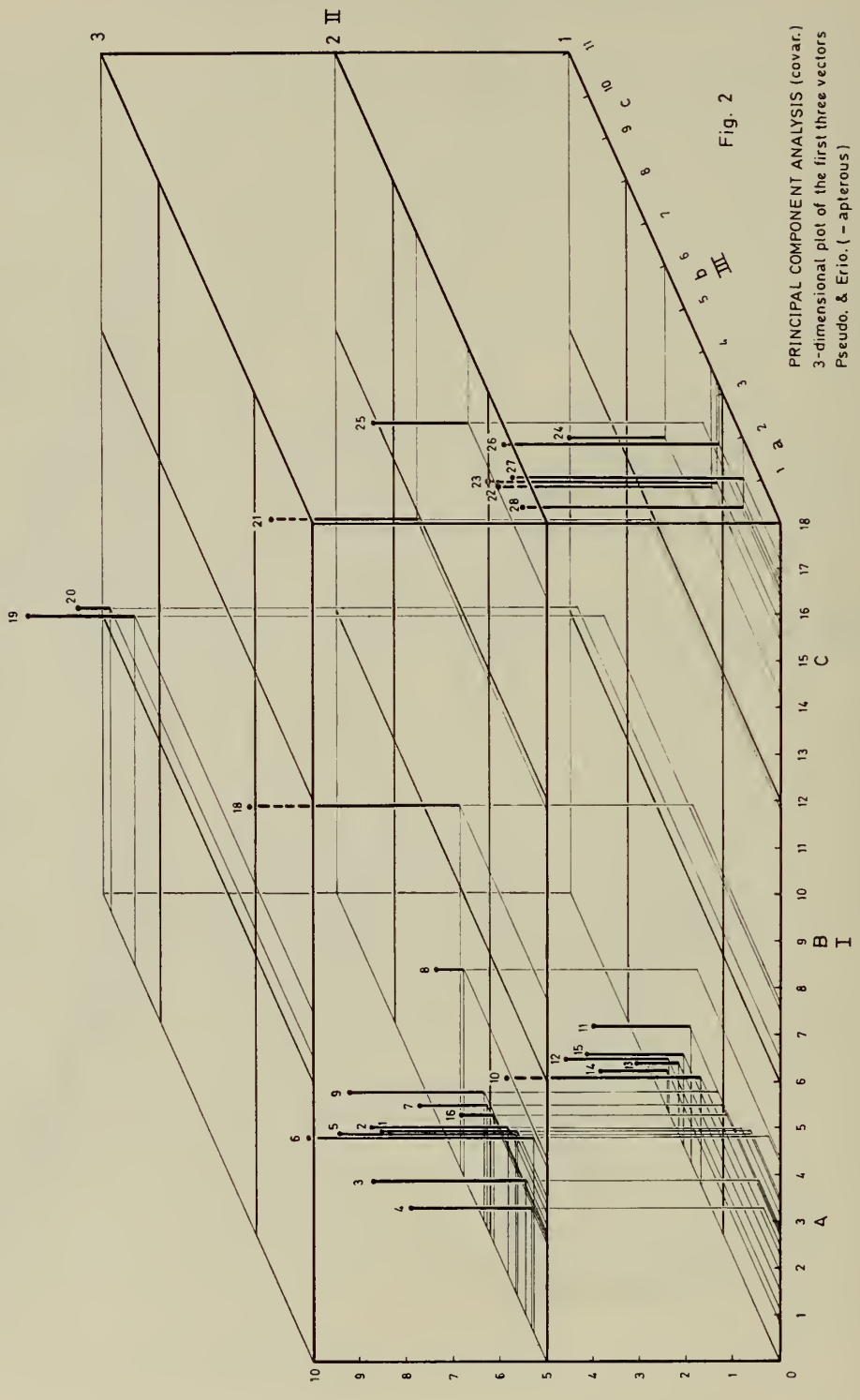

PRINCIPAL COMPONENT ANALYSIS (covar.)
3-dimensional plot of the first three vectors
Pseudo. & Erio. (– apterous)
I
II
III
A
B
C

Fig. 2

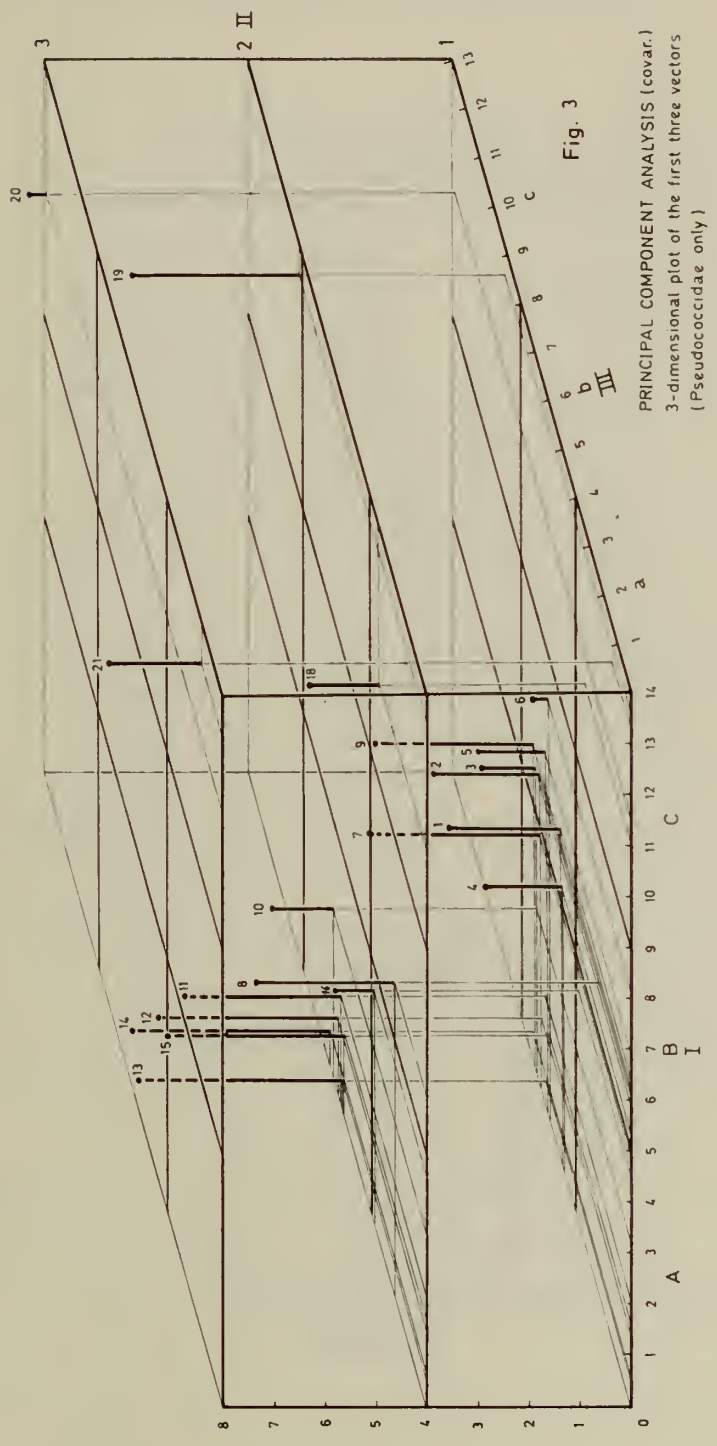
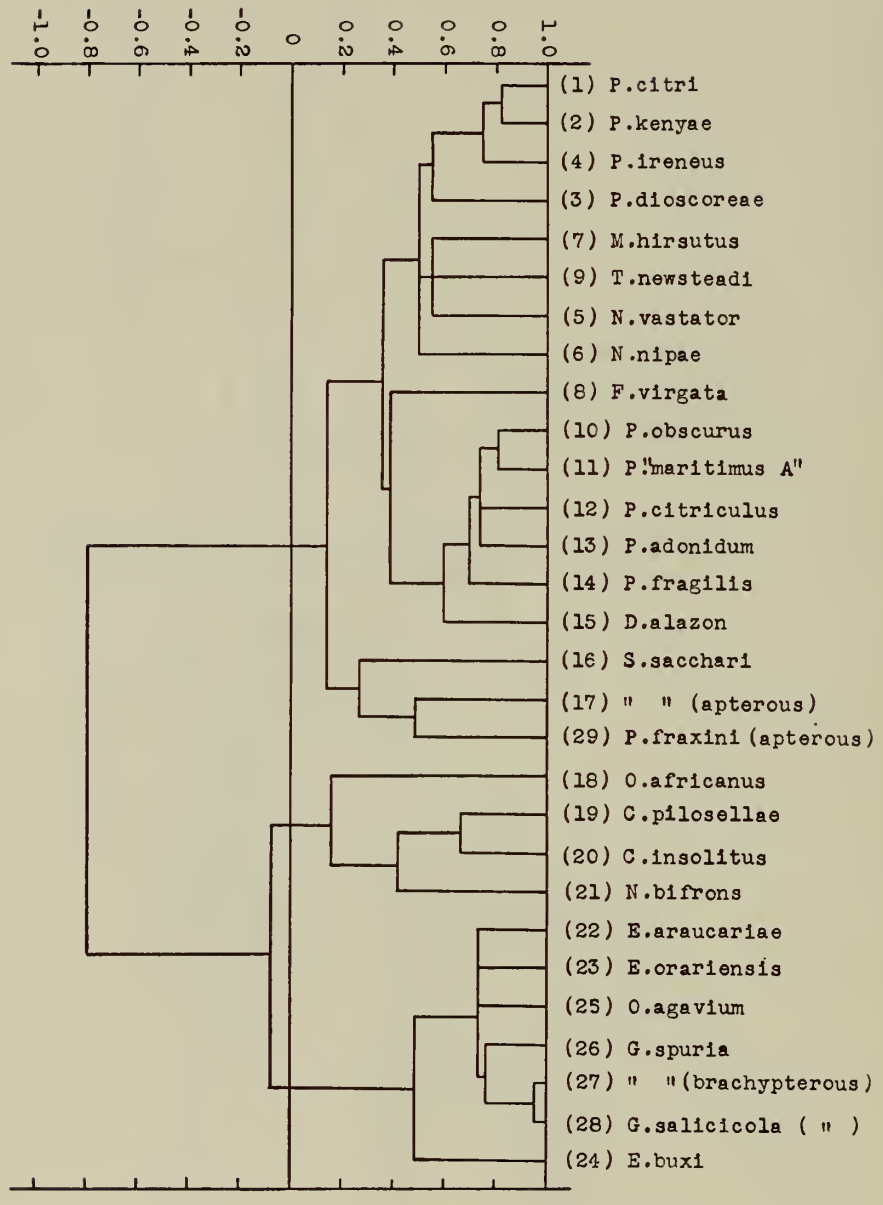
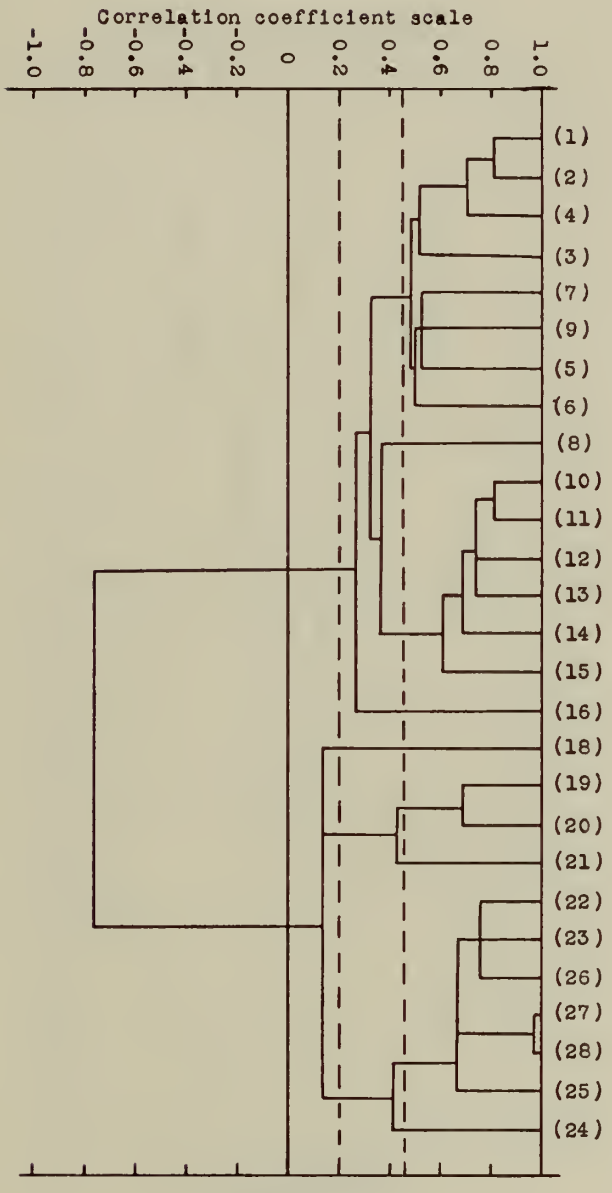

PRINCIPAL COMPONENT ANALYSIS (covar.)
3-dimensional plot of the first three vectors
(Pseudococcidae only)
I
II
III
A
B
C
a
b
c

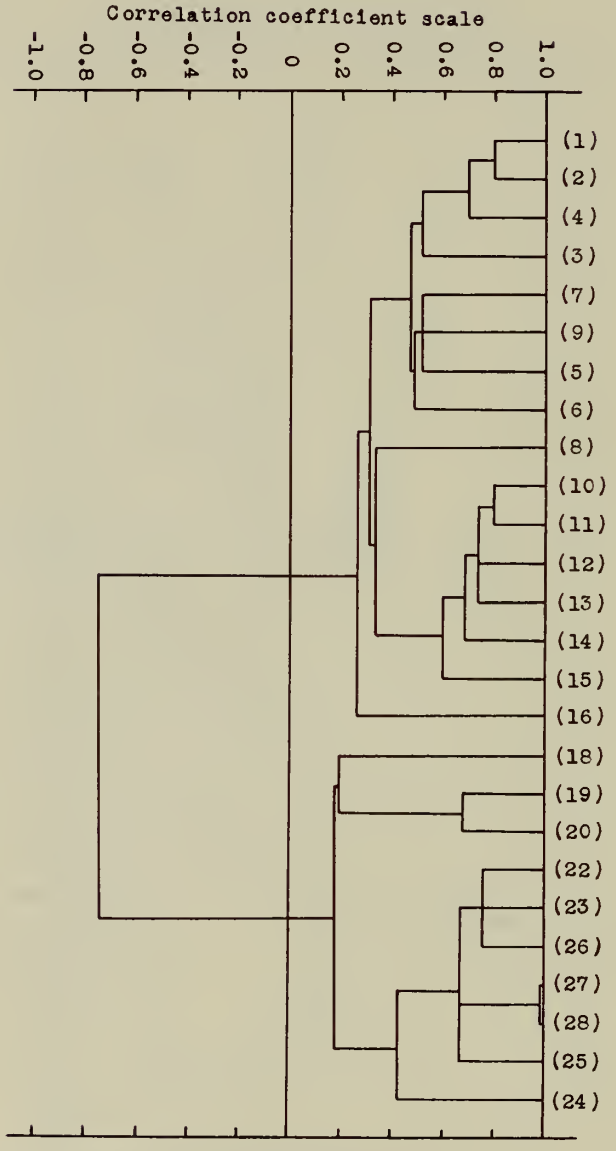
Fig. 3



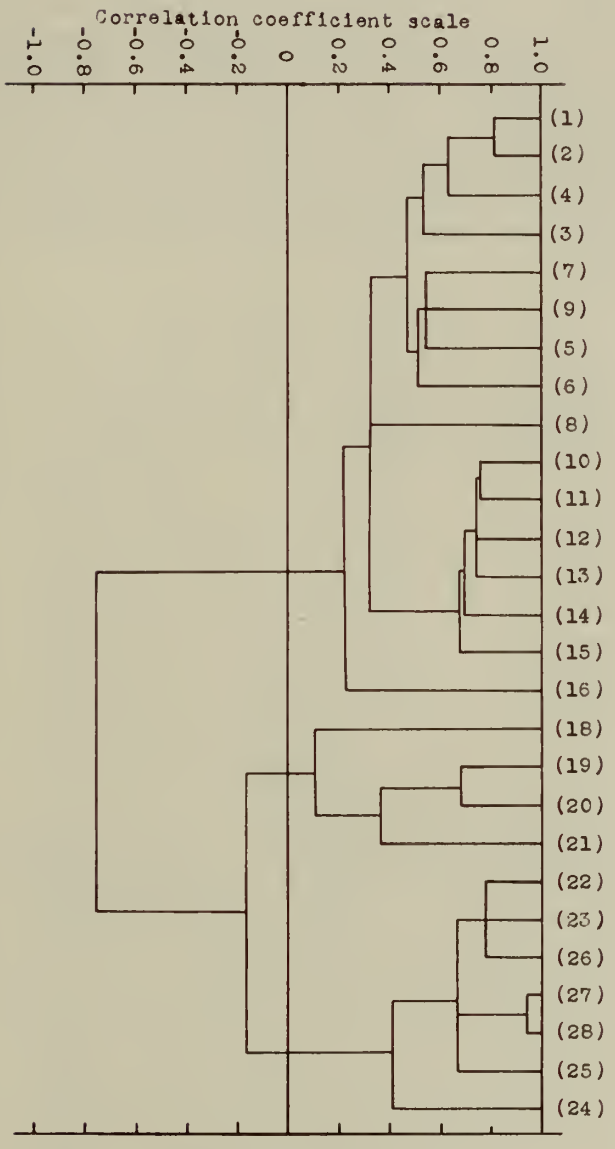
Dendrogram A.



Dendrogram B.



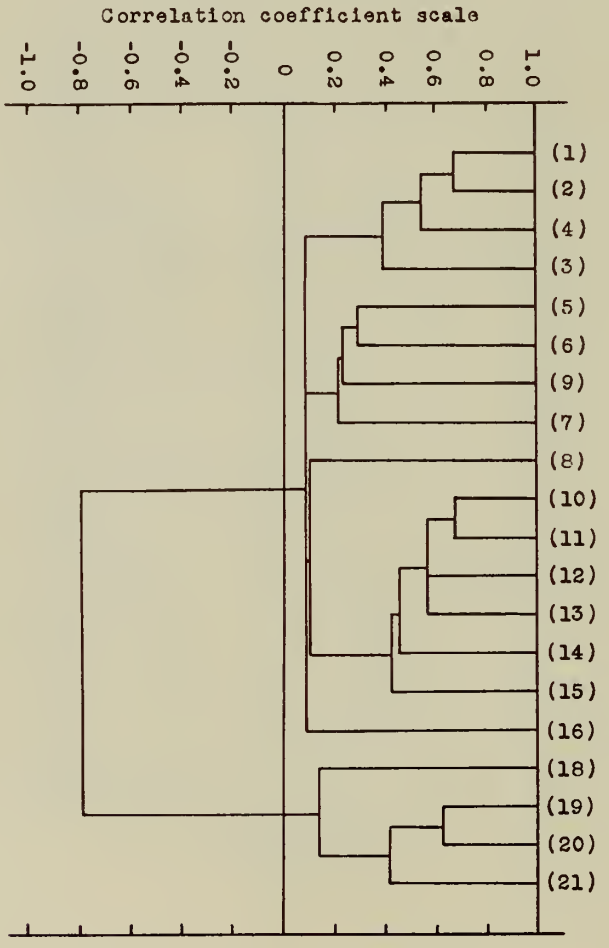
Dendrogram C.



Dendrogram D.

sides ; the vertical position is referred to as " level " above which the species is located. This way of plotting was suggested by Dr. K. Boratynski.

In the Taxon programme the usual correlation coefficient matrix is generated (each diagonal value = 1), and a series of clustering cycles are made. After each cycle, a new correlation coefficient matrix is recalculated. In the employed weighted pair-group method (WPGM) only the two most highly correlated stems are allowed to join at each clustering cycle. Members of a cluster include either the individual species or the smaller clusters to form another cluster of a higher rank. The growing clusters join the more remote relatives at a lower point of similarity (or correlation coefficient). The dendograms of Figs. A, B, C, D and E are prepared to illustrate the values of correlation coefficient at which the OTU's or their groups are joined together.



Dendrogram E.

Table I

Data of the species of Pseudococcidae prepared for plotting

Latent root	I	II	III
% of variance (Trace)	29·41%	15·96%	11·33%
Integral number added to make the latent values positive.	+6	+5	+6
Species	Latent values		
1. P. citri	6·42	2·18	5·16
2. P. kenyae	6·13	2·05	6·59
3. P. dioscoreae	5·98	1·06	6·89
4. P. ireneus	5·38	1·48	5·02
5. N. vastator	6·98	1·32	6·17
6. N. nipae	8·17	0·29	5·96
7. M. hirsutus	4·97	3·35	6·52
8. F. virgata	6·13	6·72	2·32
9. T. newsteadi	6·18	3·06	7·14
10. P. obscurus	3·27	5·18	6·81
11. P. "maritimus A"	2·13	7·05	6·17
12. P. citriculus	1·41	7·51	6·50
13. P. adonidum	0·52	7·94	6·14
14. P. fragilis	0·55	7·82	7·09
15. D. alazon	1·69	7·43	5·88
16. S. sacchari	4·56	4·74	3·74
18. O. africanus	11·08	5·40	3·27
19. C. pilosellae	13·62	7·31	8·94
20. C. insolitus	11·51	8·31	12·87
21. N. bifrons	13·33	9·81	0·84

Results

The results of the Principal Component analyses are shown in Figs. 1, 2 and 3. In Fig. 1, in which all species were considered (including the apterous forms), the macropterous forms are situated in the upper part of the diagram, and except *S. sacchari* (16) above the third level, while the two apterous forms (*S. sacchari*, 17 and *P. fraxini*, 29) near the base, below the second level. This is attributed to the fact that these males, unlike the apterous males of other families (e.g. Diaspididae, Ghauri 1962) are greatly degenerate and have lost most of their morphological structures. They show considerable differences as compared with the macropterous forms even of the same species. It has been decided therefore to exclude these two species, and another set of calculations for the macropterous males only was made ; the results are illustrated in Fig. 2. The two diagrams are virtually identical as far as the relative position of the species are concerned, except for *S. sacchari* (16) whose position is closer to *Planococcus* group (spp. 1–9). The relative position of the species, as shown in Fig. 2, will be discussed in greater detail since it appears to illustrate the relationships more clearly. Pseudococcidae (1–21) are well separated from Eriococcidae (22–29) by a vertical place passing diagonally

across the base through the near left and the far right edges of the block diagram. The Pseudococcidae are situated beyond this plane and the Eriococcidae in front of it. *Nairobia* (21) lies in the plane near Eriococcidae. *Pseudococcus* group (10–15) occupy space (Ab) on the " ground floor level " ; *Planococcus* group (1–9) space (Aa) on the " first floor level " except *F. virgata* (8) which occupies space (Ab) on the same floor. The position of *Saccharicoccus* (16) indicates that it is probably more closely related to *Planococcus* group than is *F. virgata* (8). All these species, however, are concentrated in the left-hand corner of the block diagram forming a rather close group of genera. *Octococcus* (18) occupies a solitary position in the near left upper part of space (Bb) of the second floor, and *Ceroputo* and *Centrococcus* (19 and 20) are closely approximated in space (Bc) of the third floor. The Eriococcidae form a fairly compact group in the spaces (Ca) and (Cb) on the ground floor, with *O. agavium* (25) isolated on the second level in space (Cb). *Nairobia* (21) is situated in the same space (Bb), second level) as *Octococcus* (18), but very near the right margin and close to Eriococcidae. The diagram of Pseudococcidae alone (Fig. 3) shows similar relationships, only with differences regarding the position of the groups ; in this diagram *F. virgata* (8) is also removed from *Planococcus* group.

The results of the Taxon analyses are basically in accord with those of the Principal Component. The dendogram of Fig. (A) also shows that the apterous males of *S. sacchari* (17) and *P. fraxini* (29) are highly correlated. In Fig. (B), where both species were excluded, it is apparent that the two brachypterous forms of *Gossyparia* (27 and 28) are the most closely related (with a similarity coefficient 0·97), i.e. more than the macropterous (26) and the brachypterous (27) forms of *G. spuria*. This again indicates the considerable differences apparently resulting from the conditions of the wings. This dendogram shows that *F. virgata* (8) is far removed from *Planococcus* group and is closer to *Pseudococcus* group. When a phenon line was drawn at the correlation coefficient point of 0·45, the six groups of genera suggested for Pseudococcidae were distinctly separated (except for the position of *F. virgata*). It was also possible to draw another phenon line at 0·2 correlation coefficient, which roughly separates the two suggested major taxa or sections, i.e. *Planococcus*, *Pseudococcus* and *Saccharicoccus* on the one hand, and *Ceroputo* and *Nairobia* on the other (leaving *Octococcus* isolated). These dendograms illustrate the most noteworthy conclusion. They indicate that *Octococcus*, *Ceroputo* and *Nairobia* groups of genera have greater phenetic affinity with Eriococcidae than with Pseudococcidae. It was already suggested that *N. bifrons* (21) ostensibly represents a link between the two families. But when a third programme was run excluding this species, similar results were obtained (Fig. C). When the state conditions of most characters were reduced so that almost all characters had only 2–3 states, the results were still not much different (Fig. D). The dendogram of Fig. (E) is only concerned with Pseudococcidae, where the relationships between the species are amplified and where no substantial differences occurred.

DESCRIPTION OF SPECIES

The following descriptions, conforming with those of Ghauri (1962) and Giliomee

(1967) for Diaspididae and Coccidae respectively, contain all morphological details which could be observed ; some of these might seem unnecessary, but it was done deliberately since the evaluation of the importance of the various characters has yet to be decisively determined.

PSEUDOCOCCIDAE

PLANOCOCCUS Group

PLANOCOCCUS Ferris, 1950

Planococcus citri (Risso)

(Text-figs. 4, 5)

The males of this species were described with varying degrees of accuracy by Newstead (1903), Leonardi (1920), Green (1922), Makel (1942), Jancke (1955), Theron (1958) and Beardsley (1960).

The winged forms only are known ; living individuals light brown in colour, with much darker thorax and a blackish tinge on the wings. A narrow and slender species, moderately long, with moderately long antennae and legs. When mounted, 966–1232 (1120)μ long, 266–308 (280)μ wide at mesothorax and 2142–2380 (2282)μ wing expanse.

Body setae and *derm pores :* The antennae and the legs with numerous fleshy and few hair-like setae of subequal lengths, about 31μ long on the antennae and 24μ long on the legs ; the body itself with hair-like setae only, also about 24μ long. Quadrilocular and occasionally trilocular and quinquelocular disc pores, about 6μ in diameter present on the head, the thorax and the abdomen.

Head : Irregular tetrahedron ; widest across the genae, tapering anteriorly and ventrally ; *ventral preocular depression* moderately pronounced. Length from apex to postoccipital ridge 113–128 (122)μ ; from apex to neck 153–174 (165)μ ; width across the genae 183–214 (198)μ. *Dorsal arm of midcranial ridge* anteriorly separated from the other arms and reaching the posterior margins of the dorsal eyes. *Ventral arm* anteriorly giving off the two *lateral arms of midcranial ridge*, forming together a distinct Y-shaped ridge (Text-fig. 4,B). *Postoccipital ridge* slender, U-shaped and with the anterior ends extending towards, but not reaching the preocular ridges ; this ridge was described by Theron (1958) as two short meniscate ridges but in the specimens examined, the ridge was found medially continuous. *Dorsomedial part of epicranium* slightly raised. *Preocular + interocular ridges* strong, joining the *postocular ridge* just below the ocellus ; a sclerotized rudiment of the preocular ridge below the articular process, well marked. *Genae* membranous. *Eyes :* Corneae of the *dorsal simple eyes* 18–24 (21)μ in diameter and both separated by 92–104 (95)μ i.e. 3·8–5·6 (4·1) times their diameter apart. *Ventral simple eyes* slightly larger, 24–31 (28)μ in diameter and 24–43 (31)μ apart. Lateral *ocelli* well developed. *Cranial apophysis* apically truncate ; *tentorial bridge* slender and the *anterior tentorial arms* fused just before meeting the apophysis. *Dorsal head setae* 7–12 (9·3) on each side of the median line ; each gena always with 3 *genal setae*. *Ventral head setae* present in 3 well defined groups on each side : a group of 2–3 (2·6) setae forming on both sides an irregular longitudinal row between the ventral eyes ; a group of 6–10 (7·9) setae forming with their partners of the other side a transverse band in front of the ventral eyes ; a group of 2–4 (3·2) setae present anteriorly in a longitudinal row on each side of the ventral arm of the midcranial ridge. *Head pores :* Two *dorsal head pores* always occur on each side near the base of the antennal scape.

Antennae : Filiform ; normally 10-segmented but sometimes two or more adjacent segments of the flagellum fused or incompletely separated ; 589–631 (616)μ long, i.e. somewhat longer than half the body length (the ratio 1 : 1·6–1·9, av. 1·8), and somewhat shorter than the hind legs, the ratio 1 : 1·1–1·2 (1·16). *Scape* 37–43 (40)μ long and just as wide at the base ; with 4–7 (5·6) h.s. *Pedicel* 58–64 (61)μ long and 34–37 (35)μ wide ; with 19–26 (22·9) f.s., 3–10 (6·9) h.s. and a *sensillum placodeum. Flagellum :* Segment III club-shaped, about as long as segment X, and both being longest of all (the ratio lengths of segments III to X 1 : 0·9–1·1, av. 1·0) ; the ratio width to length of segment III 1 : 3·3–4·1 (3·9). Segments IV to X cylindrical and 21–24 (22)μ wide ; the ratio width to length of segment IX being 1 : 2·4–3·0 (2·8). In the following table are shown the lengths of segments III to X and the number of setae on each:

	III	IV	V	VI	VII	VIII	IX	X
lengths in μ	76–89	49–55	52–61	55–64	55–64	61–64	58–64	78–89
(av.)	(82)	(52)	(55)	(61)	(61)	(63)	(61)	(82)
f.s.	10–17	11–18	13–18	13–18	13–20	12–16	12–17	13–20
(av.)	(12·8)	(12·9)	(14·8)	(15·5)	(14·7)	(14·2)	(14·1)	(16·1)
h.s.	2–5	1–3	1–3	1–3	1–2	1–2	1–2	1–2
(av.)	(3)	(1·8)	(2·2)	(1·9)	(1·6)	(1·7)	(1·4)	(2)

Antennal bristles easily distinguishable from the fleshy setae ; segments VIII and IX each with a ventral bristle, about 43μ long. Segment X with 3 preapical bristles, two lateral, also about 43μ long and one dorsal, slightly shorter ; this segment also with two capitate *subapical setae*, about 40μ long, and one apical hair-like seta.

Thorax : 426–540 (486)μ long. *Prothorax : Pronotal ridges* medially interrupted at a weak point. *Lateral pronotal sclerites* and *post-tergites* small. *Proepisternum + cervical sclerite* well developed, with the usual constriction which indicates the point of fusion between the two component parts ; Theron (1958) called it propleuron + cervical sclerite, regarding it as a ridge-like structure, but according to the writer's observations, the small episternum is distinct and its dorsal margin only is ridge-like. It articulates posteriorly with the coxa by means of a short *propleural ridge*, above which a small *apophysis* is invaginated. *Prosternum* triangular, 31–46 (40)μ long; posteriorly bounded by a transverse, 70–92 (79)μ long *prosternal ridge. Prothoracic setae* on each side : *Medial pronotal setae* 1–2 (1·4) ; *lateral pronotal setae* usually absent but one seta may occasionally occur on either side (av. 0·2). *Antespiracular dorsal setae* 2–4 (2·9), and one *antespiracular ventral seta* always present. *Prosternal setae* usually one and occasionally two (av. 1·1). *Prothoracic disc pores* on each side : *Medial pronotal pores* 1–2 (1·2) ; *lateral pronotal pores* 3–6 (4·3) ; *antespiracular dorsal pores* 2–3 (2·2). Ventral *prosternal* pores 0–2 (0·5).

Mesothorax : Prescutum subrectangular in dorsal view ; 70–82 (79)μ long and 107–119 (116)μ wide (ratio 1 : 1·4–1·6, av. 1·5) ; laterally bounded by the *prescutal ridge* and posteriorly by the *prescutal suture. Scutum* comparatively large, with the antero-lateral extremities heavily sclerotized and with a narrow median longitudinal membranous area ; the scutum 107–116 (110)μ long, i.e. the ratio lengths of prescutum to scutum 1 : 1·3–1·5 (1·4). *Prealare, prealar ridge, triangular plate, tegula, anterior* and *posterior notal wing processes* well developed. *Scutellum* pentagonal, 49–61 (55)μ long and 89–104 (95)μ wide, the ratio being 1 : 1·6–1·9 (1·7) and the ratio its length to the length of the scutum 1 : 1·8–2·3 (2·0). *Postalare* with well separated *anterior* and *posterior postalar ridges ; postnotal apophysis* strong. *Mesopleuron : Mesopleural ridge* interrupted at a short distance above the coxal articulation ; Theron (1958) neither commented on this interruption nor showed it in his illustrations. *Mesopleural apophysis, mesopleural wing process, basalare* and *subepisternal ridge* well developed ; *subalare* small. The two parts of the *episternum* weakly sclerotized ; *lateropleurite* thin ; *mesepimeron* small. *Mesosternum : Basisternum* 134–143 (140)μ long and 156–183 (171)μ wide ; bounded antero-laterally and posteriorly by the *marginal* and the *precoxal ridges* respectively ; *furca* strong. *Mesothoracic spiracles* 15–21 (18)μ wide at opening, with 31–37 (34)μ long supporting

bar. *Mesothoracic setae* on each side : *Prescutal setae* 2–5 (3·3) ; *scutal setae* 9–12 (10·1) ; *scutellar setae* 2–4 (3·1) ; *tegular setae* 1–3 (1·9). *Postmesostigmatal setae* absent medially and occur laterally in two groups behind the spiracle, the dorso-lateral group comprising 1–3 (1·7) setae, and the ventro-lateral with 4–6 (5·1) setae. The *basisternal setae* 9–16 (12·6). *Mesothoracic disc pores : Mesospiracular pores* 1–2 (1·3) behind each spiracle.

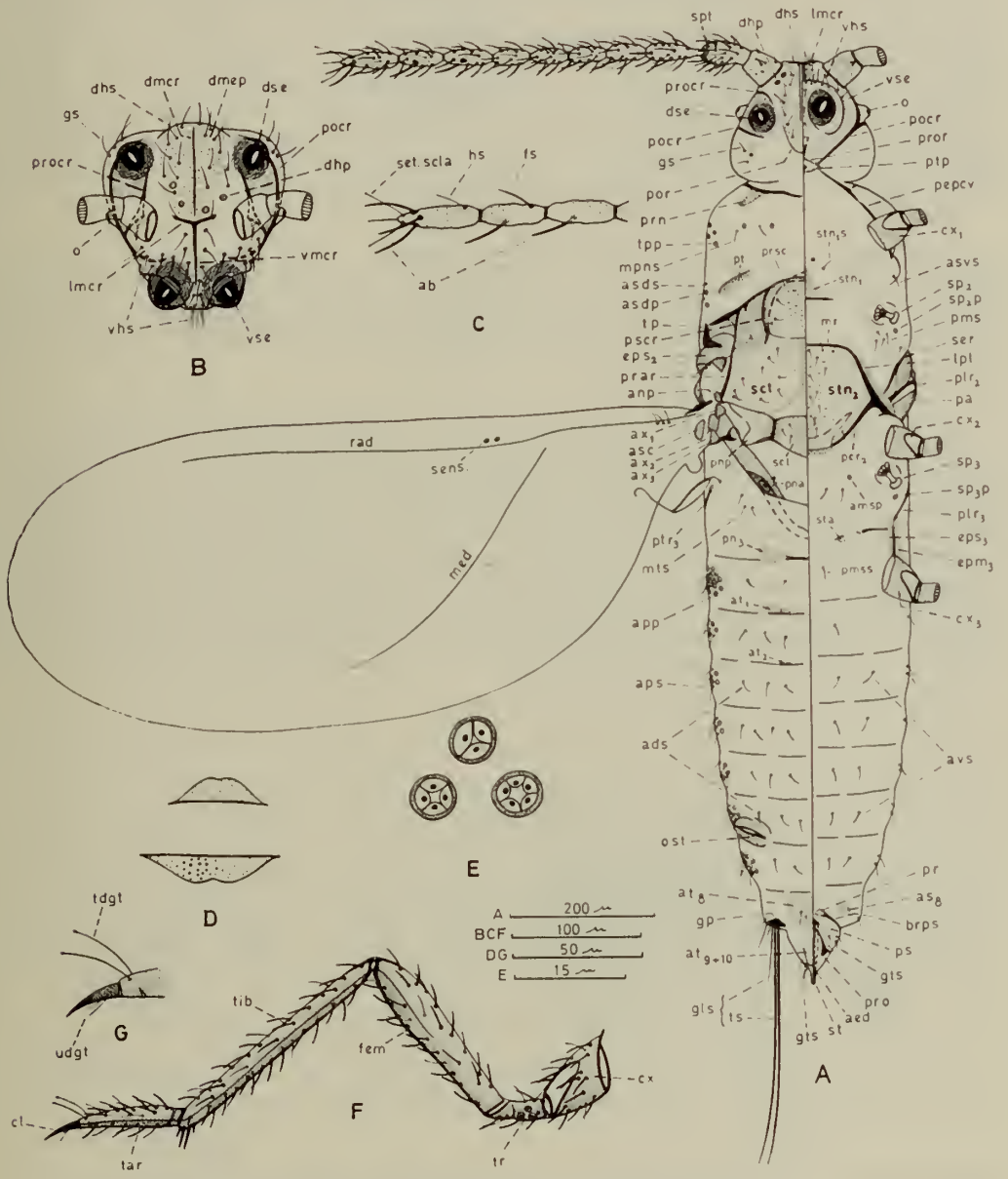


FIG. 4. *Planococcus citri* (Risso), dorsal and ventral view.

Metathorax : Metapostnotal sclerites medially connected by the transverse *metapostnotal ridge* ; the latter, which appears to be of taxonomic importance, was overlooked by Theron (1958). *Metapleural ridge* attenuates near the middle at a small *pleural apophysis ;* the metapleural ridge dorsally merges into a small *metapleural wing process. Metepisternum* dorsally supports the *precoxal ridge of metathorax ; metepimeron* irregularly triangular. *Metasternal apophysis*, whose absence was emphasized by Theron (1958) and regarded as a specialized feature of the lecanoid type of male (which includes *P. citri* as a representative of Pseudococcidae), is definitely present. *Metathoracic spiracle* identical with the mesothoracic. *Metathoracic setae* on each side : A submedian group of 3 *metatergal setae* always present ; *metapleural setae* usually absent, but one seta was found in one specimen (av. 0·1) ; *anterior metasternal setae* 1–2 (1·9) forming, with their partners of the other side, a short median transverse row ; *posterior metasternal setae* 1–2 (1·7) in a similar arrangement. *Metathoracic pores : Metaspiracular pores* 1–2 (1·1) behind each spiracle, and one *anterior metasternal pore* may occur on either side (av. 0·5) ; *posterior metasternal pores* absent.

Wings : 938–1050 (1008)μ long and 378–476 (420)μ wide ; usually with 3 *alar setae* (4 setae observed in one occasion, av. 3·1) ; a compact row of 2–3 (2·2) minute *circular sensoria* also apparent. *Hamulohalterae* 70–76 (74)μ long and about 15μ wide; with a weak *ridge* and an apical, 61–67 (64)μ long hooked seta, i.e. the seta slightly shorter than the hamulohaltera, the ratio their lengths being 1 : 1·1–1·2 (1·15).

Legs : Comparatively long and moderately stout ; the ratio length of the hind leg to the total body length 1 : 1·3–1·7 (1·6). *Coxa* and *trochanter* about 46 and 24μ wide ; the proximal part of the latter longer than the distal and with 3 *circular sensilla* on each side. *Femur* about 37μ wide ; that of the fore leg shortest and that of the hind leg longest ; the ratio width to length of the hind femur 1 : 5·2–5·8 (5·4). *Tibia* 21μ wide ; with 2 strong apical spurs and 2–4 smaller spines ; in front leg, the femur shorter than the tibia, the ratio their lengths 1 : 1·1–1·2 (1·13). The distal segment of the *tarsus* about 21μ wide ; *tarsal digitules* apically knobbed, 34–40 (37)μ long. *Claw* gradually tapering ; *ungual digitules* extremely fine, about 15μ long. The following table shows the lengths of the leg segments in microns and the number of fleshy and hairlike setae on each :

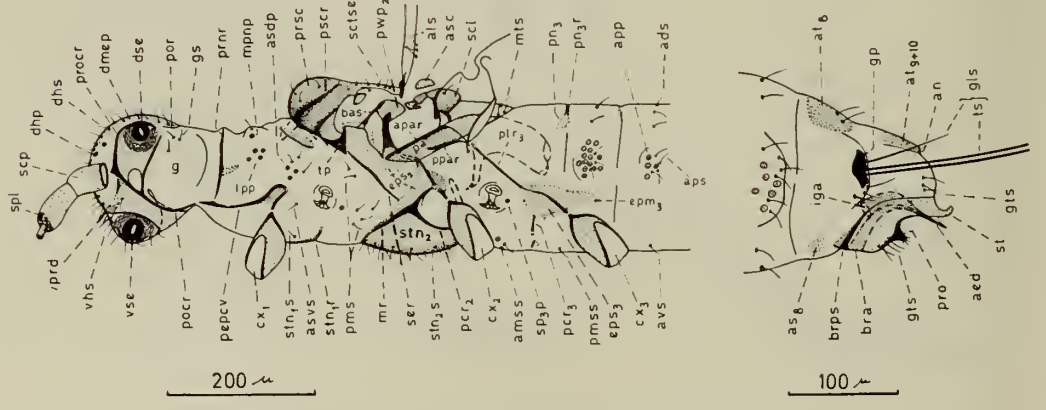


FIG. 5. *Planococcus citri* (Risso), lateral view.

		Fore Leg	Middle Leg	Hind Leg
	length	37–46 (40)	40–49 (43)	46–52 (49)
Coxa	f.s.	10–18 (13·2)	12–19 (15·1)	13–22 (17·3)
	h.s.	5–9 (6·8)	5–10 (6·2)	6–11 (8·8)
	length	55–61 (59)	55–61 (60)	58–64 (62)
Trochanter	f.s.	3–8 (4·3)	3–9 (5·9)	4–9 (6·4)
	h.s.	2–4 (2·9)	2–4 (3·0)	2–5 (3·2)
	length	177–183 (180)	183–198 (189)	192–211 (198)
Femur	f.s.	22–31 (26·9)	25–36 (28·6)	32–45 (36·4)
	h.s.	4–7 (5·0)	4–8 (5·9)	5–9 (6·9)
	length	201–211 (204)	217–232 (223)	256–278 (265)
Tibia	f.s.	36–47 (41·6)	43–54 (47·6)	52–64 (58·3)
	h.s.	5–9 (6·8)	6–9 (7·3)	5–9 (7·1)
	length	89–95 (92)	89–98 (95)	101–107 (104)
Tarsus	f.s.	21–27 (23·7)	22–34 (26·5)	24–37 (28·8)
	h.s.	2–5 (3·1)	3–6 (4·2)	3–7 (4·6)
Claw	length	34–40 (37)	34–40 (37)	34–40 (37)
Total length of leg		598–619 (607)	628–662 (641)	695–735 (714)

Abdomen : 304–494 (395)μ long and 220–289 (258)μ wide. The tergites of segments I and II small ; that of segment VIII large and that of segments IX + X distinct. *Sternites* of segment VIII weakly sclerotized. *Ostioles* well developed, 27–34 (30)μ long at orifice. *Abdominal setae on each side : Dorsal setae* 2–3 on segments I and VII, 3–4 on segments II to VI, and always 2 on segment VIII. *Pleural setae* 3–5 on segments I to VII, and 2–3 on segment VIII, in addition one conspicuously longer seta. *Ventral setae* 1–2 on segment II, 2–3 on segments III to VII, and absent on segment VIII. *Abdominal disc pores* only in lateral groups on each side ; segments I to VII with 11–18 (14·1), 2–4 (3·1), 2–4 (2·7), 2–4 (2·7), 2–4 (2·3), 3–6 (4·0) and 5–8 (6·2) pores, respectively.

Glandular pouches well developed ; *setae of glandular pouch* include a pair of long *tail setae* 299–342 (323)μ long and one seta, 70–104 (82)μ long, i.e. the ratio lengths of the tail setae to the length of the body 1 : 3·0–3·7 (3·5).

Genital segment comparatively small ; conical in dorsal view, with a short and narrow style, which is curved upwards in lateral view. *Penial sheath* 107–113 (109)μ long and 73–82 (76)μ wide (the ratio 1·3–1·5, av. 1·4 : 1, and the ratio its length to the total body length 1 : 8·8–11·4, av. 10·2). *Basal ridge of penial sheath* with a small *projection*. *Process of penial sheath* well pronounced and sclerotized, with 3–4 minute *setal sensilla*. *Aedeagus* relatively short, dorso-posteriorly curving from its *basal rod* towards its pointed apex ; *internal genital aperture* distinct. *Setae of genital segment : Dorsally*, 3 setae always present on each side near the base of the style ; *ventrally* a group of 3–5 (4·1) setae occur on each side of the penial sheath.

Material : 10 specimens studied, collected by M. Kosztarab, on *Coleus* sp. (in greenhouses), in Ohio State University, Columbus, Ohio, U.S.A., 6.v.1961.

Other material : The writer also obtained adult males of this species from the following sources :

On Ivy (*Hedera helix*), in Week's Hall, one of Imperial College residential buildings, South Kensington, during the second week of June, 1963.

On *Solanum* sp. and on *Rhapes* sp., in the gardens of Manial Palace, Cairo, Egypt, U.A.R., during the second and third weeks of August, 1964.

On *Croton* sp., in the Botanic gardens of Zohreya (greenhouses), Cairo, Egypt, U.A.R., also during the second week of August, 1964.

On potato sprouts received from Dr. D. J. Williams, 30.i.1965. The culture was sent from Angola, West Africa where the insect was reported causing tremendous damage to potatoes. Dr. Williams, although he identified the females as *P. citri*, was somewhat doubtful ; the pleural prothoracic group of ducts, normally found anterior to, and around the spiracles in this species, were absent. When the males were mounted and examined, they completely agreed with the typical specimens.

Planococcus kenyae (Le Pelley)

(Text-fig. 6)

The macropterous forms only are known ; narrow and slender, of medium size, with comparatively short antennae and long legs. Mounted specimens 1092–1204 (1162)μ long, 252–294 (280)μ wide at mesothorax and 2352–2576 (2478)μ wing expanse.

Body setae and *pores :* Antennae and legs with numerous fleshy and a few hair-like setae, about 31μ long on the former and 24μ on the latter ; the body itself with hair-like setae only, about 24μ long. Quadrilocular and sometimes trilocular or quinquelocular disc pores, about 6μ in diameter, present on the head, thorax and abdomen.

Head : Subtetrahedron ; subtriangular in dorsal and front views ; *ventral preocular depression* well pronounced in lateral view. Length from apex to postoccipital ridge 113–134 (122)μ ; from apex to neck 153–174 (168)μ ; width across the genae 180–207 (195)μ. *Dorsal arm* of the midcranial ridge anteriorly detached from other arms, and almost reaching the posterior level of the dorsal eyes. *Ventral* and *lateral arms* forming together a Y-shaped ridge. *Postoccipital ridge* U-shaped, not reaching the preocular ridges anteriorly. *Dorsomedial part of epicranium* slightly raised. *Preocular + interocular ridges* well developed, posteriorly fused with *postocular ridge* below the ocellus. A distinct ventral rudiment of the preocular ridge present below the articular process. *Preoral ridge* slender. *Eyes : Dorsal simple eyes* not projecting beyond the outer margins of the head ; their corneae 21–27 (24)μ in diameter, and both separated by 85–98 (92)μ, i.e. 3·5–4·0 (3·8) their diameter apart. *Ventral simple eyes* larger and much closer, 27–34 (31)μ in diameter and 18–24 (21)μ apart. *Lateral ocelli* well developed. *Ocular sclerite* traversed by the interocular ridge. *Cranial apophysis* apically truncate. *Tentorial bridge* slender. *Dorsal head setae* 9–12 (10·2) on each side anterior to the postoccipital ridge ; each gena usually with 3 and occasionally 2 (av. 2·8) *genal setae*. *Ventral head setae* on each side : 2–4 (3·4) between the ventral eyes ; 7–10 (8·6) in the area of the ventral preocular depression, forming with their partners of the other side a transverse band ; anteriorly, 3–4 (3·3) in a longitudinal row on each side of the ventral arm of the midcranial ridge. *Head pores :* Usually 2 pores, and occasionally 3 or 4 (av. 2·3), present dorsally near the base of each antenna.

Antennae : Filiform ; 10-segmented ; 509–641 (577)μ long, i.e. about half the body length, the ratio being 1 : 1·8–2·2 (2·0), and slightly shorter than the hind leg, the ratio 1 : 1·1–1·3 (1·2). *Scape* 37–43 (40)μ long and 34–40 (37)μ wide at base ; with 5–7 (5·9) h.s. *Pedicel* 55–64 (60)μ long and 31–37 (34)μ wide at widest ; with 12–23 (17·3) f.s., 6–11 (8·9) h.s. and a *sensillum placodeum*. *Flagellum :* Segment III club-shaped, longest of all (the ratio its length to the length of segment X 1·1–1·3, av. 1·2 : 1) and about 21μ wide (the ratio its width to its length 1 : 3·8–5·2, av. 4·3). Segments IV to X cylindrical and 18–21 (20)μ wide (the ratio

width to length of segment IX 1 : 2·4–2·9, av. 2·5). The lengths of the flagellar segments and the number of setae on each as follows:

	III	IV	V	VI	VII	VIII	IX	X
length in μ	73–98	40–58	46–58	46–58	46–58	49–64	46–61	67–82
(av.)	(85)	(52)	(52)	(53)	(53)	(55)	(52)	(73)
f.s.	5–12	6–11	8–15	9–17	8–16	9–18	9–14	10–18
(av.)	(8·7)	(8·9)	(11·2)	(13·1)	(12·4)	(12·9)	(11·8)	(13·7)
h.s.	3–6	1–3	1–3	1–4	1–4	1–4	1–3	1–4
(av.)	(4·1)	(2·1)	(2·3)	(1·9)	(2·1)	(2·2)	(1·9)	(2·3)

Antennal bristles much stouter than the fleshy setae ; segments VIII and IX each with a ventral bristle ; segment X with two preapical lateral bristles and a slightly shorter dorsal one, at a greater distance from the apex. Terminal segment also with two *subapical sensory setae* and one apical hair-like seta.

Thorax : 479–555 (524)μ long. *Prothorax : Pronotal ridges* medially interrupted by a weak sclerotization ; *lateral pronotal sclerites* moderately large and well sclerotized. *Post-tergites* narrow. *Proepisternum* with a ridge-like dorsal margin. *Prosternum* triangular, 31–43 (37)μ long ; *prosternal ridge* 79–95 (85)μ long. *Prothoracic setae* on each side of the median line as follows : One *medial pronotal seta* usually present, but sometimes absent on either or both sides (av. 0·8) ; *lateral pronotal* and *post-tergital setae* absent. *Antespiracular dorsal setae* 1–3 (2·1) ; *antespiracular ventral setae* and *prosternal seta* always one. *Prothoracic disc pores* on each side : *Medial pronotal pores* 2–4 (3·2) ; *lateral pronotal pores* 2–6 (4·1) ; *antespiracular dorsal pores* 2–5 (3·4). *Prosternal pores* usually 1–2, but sometimes 3 pores may occur on either side or the pores may be absent altogether (av. 1·6).

Mesothorax : Prescutum subrectangular in dorsal view ; 76–89 (82)μ long and 104–122 (119)μ wide, the ratio being 1 : 1·3–1·6 (1·4) ; *prescutal ridges* well developed and *prescutal suture* distinct. *Scutum* heavily sclerotized antero-laterally and with a median longitudinal narrow membranous area ; scutum 95–116 (104)μ long, i.e. the ratio length of prescutum to scutum 1 : 1·1–1·4 (1·3). *Prealare, prealar ridge, triangular plate, tegula, anterior* and *posterior notal wing processes* well developed. *Scutellum* pentagonal, 46–58 (52)μ long and 82–101 (92)μ wide, i.e. the ratio 1 : 1·7–1·9 (1·8) and the ratio its length to the length of scutum 1 : 1·9–2·2 (2·0). *Anterior* and *posterior ridges of postalare* well separated ; *postnotal apophysis* strong. *Mesopleuron : mesopleural ridge* interrupted above the coxal articulation ; *mesopleural apophysis, mesopleural wing process, basalare* and *subepisternal ridge* well developed. *Mesepisternum, mesepimeron* well-defined, and *lateropleurite* narrow. *Mesosternum : Basisternum* 128–146 (140)μ long and 156–183 (171)μ wide ; *marginal* and *precoxal ridges* well developed ; *furca* strong. *Mesothoracic spiracle* 15–21 (18)μ wide at opening, with a 34–40 (37)μ long supporting bar. *Mesothoracic setae* on each side : *Prescutal setae* 4–6 (4·6) ; *scutal setae* 6–9 (7·5) ; *scutellar setae* 2–3 (2·5). *Tegular setae* 2–3 (2·1) ; *postmesostigmatal setae* 4–7 (5·1), occurring laterally behind each spiracle. *Basisternal setae* 9–14 (11·4). *Mesothoracic pores :* 1–2 *mesospiracular pores* usually present behind each spiracle, but sometimes entirely absent (av. 0·9).

Metathorax : Metapostnotal sclerites and *metapostnotal ridge* distinct. *Metapleural ridge* attenuating near the middle at the position of the *metapleural apophysis ; metapleural wing process* small. *Precoxal ridge of metathorax* well developed ; *metepisternum, metepimeron* and *metasternal apophysis* well defined. *Metathoracic spiracle* similar to the mesothoracic. *Metathoracic setae* on each side : *Metatergal setae* 2–3 (2·7) ; *metapleural setae* absent ; *anterior metasternal setae* 1–3 (2·3) ; *posterior metasternal setae* 0–2 (0·4). *Metathoracic disc pores* on each side : *Metathoracic pores* 0–1 (0·3) ; *anterior metasternal pores* 0–2 (1·2).

Wings : 1064–1162 (1120)μ long and 406–462 (434)μ wide ; usually with 4 *alar setae* and occasionally 3 or 5 (av. 3·9) ; a compact row of 2–3 (2·3) minute *circular sensoria* also present.

Axillary and *additional sclerites* distinct. *Hamulohalterae* 67–89 (73)μ long and 15–18 (16)μ wide ; with a slender ridge and a 61–67 (64)μ long, apically hooked seta, i.e. the ratio length of seta to the length of the hamulohaltera 1 : 1–1·2 (1·1).

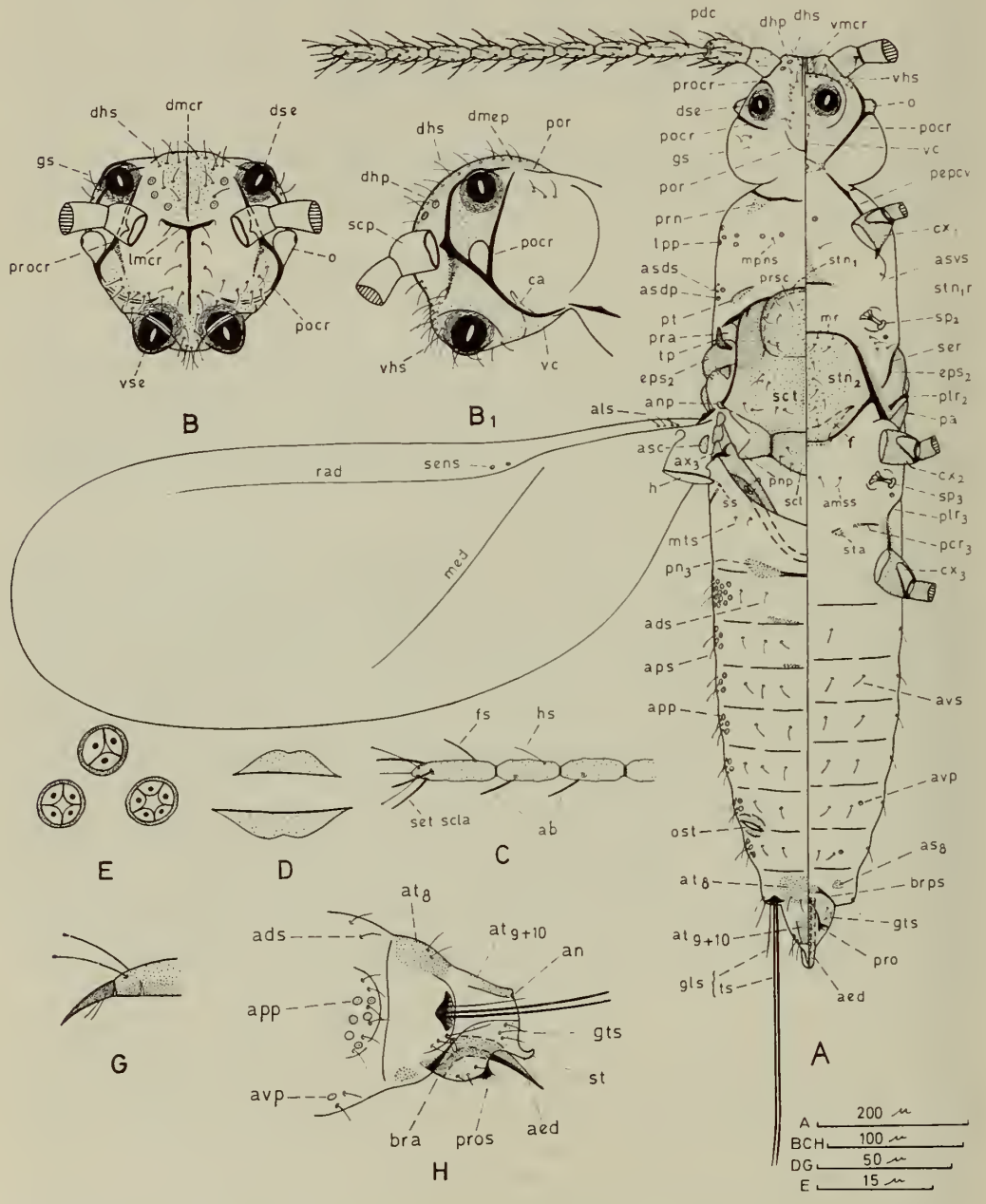


Fig. 6. *Planococcus kenyae* (Le Pelley), dorsal, ventral and lateral view.

Legs : Comparatively long and moderately stout ; the ratio length of the hind legs to the total body length 1 : 1·5–1·8 (1·7). *Coxa* and *trochanter* about 46 and 24μ wide respectively. *Femur* about 37μ wide ; that of the middle leg shortest and that of the hind leg longest ; the ratio width to length of the hind femur 1 : 5·5–6·3 (5·7). *Tibia* about 21μ wide ; with 2 apical strong spurs and 2–4 smaller spines ; in the fore legs the femur is slightly shorter than the tibia, the ratio their lengths 1 : 1·04–1·2 (1·1). *Tarsus* about 21μ wide ; *tarsal digitules* apically knobbed, 37–43 (40)μ long. *Claw* gradually tapering towards a pointed end ; *ungual digitules* with acute tips. In the following table, the lengths of the leg segments (in microns) and the number of setae on each are given :

		Fore leg	Middle leg	Hind leg
Coxa	length	40–46 (44)	43–49 (46)	46–52 (48)
	f.s.	13–19 (15·6)	14–19 (16·2)	15–21 (17·8)
	h.s.	4–8 (6·2)	5–8 (6·4)	5–10 (7·8)
Trochanter	length	58–64 (62)	58–64 (62)	61–70 (65)
	f.s.	5–8 (6·6)	5–9 (6·2)	6–9 (7·6)
	h.s.	2–4 (3·2)	2–4 (3·0)	2–4 (3·2)
Femur	length	174–189 (183)	171–186 (177)	183–211 (192)
	f.s.	24–32 (27·6)	24–30 (26·4)	31–43 (37·2)
	h.s.	4–8 (5·8)	4–8 (5·2)	4–9 (6·8)
Tibia	length	180–214 (195)	192–223 (207)	238–265 (253)
	f.s.	33–46 (40·6)	39–51 (45·4)	47–58 (53·6)
	h.s.	5–8 (6·6)	5–9 (7·2)	6–9 (7·4)
Tarsus	length	85–92 (88)	85–92 (89)	92–101 (95)
	f.s.	20–26 (23·2)	21–28 (24·8)	24–31 (27·4)
	h.s.	3–5 (3·6)	3–6 (4·4)	3–6 (4·8)
Claw	length	34–40 (37)	34–40 (37)	34–40 (37)
Total length of leg		577–634 (604)	586–637 (613)	665–738 (692)

Abdomen : 388–441 (418)μ long and 236–274 (251)μ wide. Tergites of segments I and II small and narrow ; those of segments VIII and IX + X distinct. *Sternites of segment VIII* weak. *Ostioles* well developed, 31–37 (34)μ long at orifice. *Abdominal setae* on each side : *Dorsal setae* 2–3 on segments I to VII and always 2 on segment VIII. *Pleural setae* 3–5 on segments I to VII, and always 3 on segment VIII, including one slightly longer seta. *Ventral setae* always 1 on segment II, usually 2 and sometimes 3 on segments III to VII, and absent on segment VIII. *Abdominal disc pores :* Segments I to VII with 9–16 (12·2), 3–5 (3·7), 2–4 (2·9), 2–5 (3·1), 2–4 (2·9), 3–4 (3·4), and 3–6 (4·6) *pleural pores* respectively ; segment VI also with 0–1 (0·4) and segment VII with 0·2 (1·1) *ventral pores*.

Glandular pouches well developed ; *setae of glandular pouch* consist of a pair of 336–366 (351)μ long *tail setae*, and one seta of medium length (70–92, av. 79μ long) ; i.e. the ratio length of the tail setae to the total body length 1 : 3·1–3·4 (3·3).

Genital segment small ; triangular in dorsal view, with a short narrow *style* ; the latter curving upwards in lateral view. *Penial sheath* 98–110 (104)μ long and 70–82 (76)μ wide, i.e. the ratio length to width 1·2–1·5 (1·4) : 1, and the ratio its length to the total body length 1 : 10·1–12·5 (11·2). *Basal ridge of penial sheath* with a small *projection*. *Process of penial sheath* well pronounced and usually with 3–4 minute setal sensilla. *Aedeagus* relatively long and broad, with a wide *internal genital aperture*. *Setae of the genital segment : Dorsally*, 3 setae always present on each side near the base of the style ; *ventrally* 3–4 (3·5) slightly smaller setae occur on each side of the penial sheath.

Material : 10 specimens examined, collected by T. J. Crowe, on *Coffea arabica*, in Ruiru, Kenya, 25.ix.1962.

Remarks : This species, although closely related to *P. citri*, could be separated by having : the third antennal segment longer than the terminal ; the femur of the middle leg shortest ; a ventral pore, at least on one side of abdominal segment VII ; a comparatively stouter aedeagus.

Planococcus dioscoreae Williams

(Text-figs. 7, 8)

Only the winged forms known ; living specimens not available. The mounted males narrow and slender, of medium or large size, with short antennae and moderately long legs. The total length of the body 1246–1400 (1330)μ, the width at mesothorax 280–308 (290)μ and the wing span 1960–2128 (2044)μ.

Body setae and *pores :* Numerous fleshy and few hair-like setae occur on the antennae and the legs ; the body itself with hair-like setea only. All the setae about 21μ long. Quadrilocular and few quinquelocular disc pores present on the head, thorax and abdomen, about 6μ in diameter.

Head : Subtetrahedron ; subtriangular in dorsal and front views ; *ventral preocular depression* well pronounced in lateral view. Length from apex to postoccipital ridge 116–122 (120)μ ; from apex to neck 168–183 (174)μ ; width across the genae 198–229 (207)μ. *Dorsal arm of midcranial ridge* weak, anteriorly detached from the other arms and posteriorly reaching the hindmost level of the dorsal eyes. *Ventral* and *lateral arms of midcranial ridge* forming together a Y-shaped ridge. *Postoccipital ridge* (por) slender, anteriorly continuous with the preocular ridges ; the postoccipital ridge binds the *dorsomedial part of epicranium* (dmep) posteriorly. *Preocular* and *interocular ridges* intimately joined to the *postocular ridge* ; ventral rudiment of the preocular ridge well marked by a short sclerotization just below the articular process. *Preoral ridge* slender. *Genae* large and membranous. *Eyes : Dorsal simple eyes* not projecting beyond the outer margins of the head in dorsal view ; their corneae 21–27 (24)μ in diameter and separated by 98–107 (104)μ, i.e. 3·9–4·6 (4·3) times as much as the corneae apart. *Ventral simple eyes* slightly larger and much closer, 27–31 (29)μ in diameter and 21–27 (24)μ apart. *Lateral ocelli* comparatively large and dorsally supported by a slender *ocellar ridge*. *Ocular sclerites* traversed by the interocular ridges. *Cranial apophysis* apically truncate. *Tentorial bridge* slender. *Dorsal head* setae 8–12 (9·7) on each side of the median line ; each gena with 2–3 (2·7) *genal setae*. *Ventral head setae* on each side : 3–4 (3·4) between the ventral eyes ; a group of 9–11 (10·4) setae forming with their partners of the other side a transverse band in the area of the ventral preocular depression ; 2–3 (2·4) setae on each side of the ventral arm of the midcranial ridge. *Head disc pores :* Dorsally, 5–8 (6·4) pores present on each side near the base of the antennal scape ; ventral pores absent. *Antennae :* Filiform ; normally 10-segmented ; 616–665 (641)μ long, i.e. about as long as half the body length and slightly shorter than the hind legs, the ratios being 1 : 2·0–2·1 (2·05) and 1 : 1·1 respectively. *Scape* 43–46 (45)μ long and 43–49 (46)μ wide at base ; with 4–7 (5·0) h.s. *Pedicel* 61–67 (63)μ long and 34–37 (35)μ wide at widest ; with 15–21 (18·4) f.s., 5–12 (9·3) h.s., and a distal *sensillum placodeum*. *Flagellum :* Segment III club-shaped, being the longest of all, and about 25μ wide ; the ratio lengths of segments III to X 1·1 : 1 and the ratio width to length of segment III 1 : 3·6–3·7 (3·65). Segments IV to X cylindrical and about 23μ wide ; segments IV–IX subequal in length, and the terminal segment slightly longer ; the ratio width to length of segment IX 1 : 2·7–2·9 (2·8).

The following table shows the lengths of the flagellar segments and the number of setae on each :

	III	IV	V	VI	VII	VIII	IX	X
length in μ	79–89	61–64	55–61	58–64	61–64	61–67	61–64	73–79
(av.)	(85)	(62)	(58)	(61)	(62)	(64)	(62)	(76)
f.s.	11–16	12–14	11–16	12–14	15–16	13–15	14–16	13–16
(av.)	(13·5)	(13·0)	(13·5)	(13·0)	(15·5)	(14·0)	(15·0)	(14·5)
h.s.	3–4	2–4	2–3	2–3	2–3	3–4	3–4	4–5
(av.)	(3·5)	(3·0)	(2·5)	(2·5)	(2·5)	(3·5)	(3·5)	(4·5)

Antennal bristles : Segments VIII and IX each with a ventral antennal bristle, about 34μ long ; segment X with 3 similar, preapical bristles, the dorsal of which is slightly shorter and at a greater distance from the apex. Terminal segment also with two capitate *subapical sensory setae*, about 37μ long, and one apical hair-like seta.

Thorax : 509–547 (524)μ long. *Prothorax : Pronotal ridges* interrupted in the middle ; *lateral pronotal sclerites* and *post-tergites* small. *Proepisternum* with ridge-like dorsal margin ; *propleural ridge* short and *propleural apophysis* small. *Prosternal ridge* double barred, 76–92 (85)μ long. *Prothoracic setae* on each side of the median line : One *medial pronotal seta* usually present (av. 0·9) ; one *lateral pronotal seta* also may be present or absent (av. 0·8) ; *post-tergital setae* absent. *Antespiracular dorsal setae* 1–2 (1·8) h.s. One *antespiracular ventral seta* and one *prosternal seta* always *present. Prothoracic disc pores* on each side : *Medial pronotal pores* 5–10 (8·4) ; *lateral pronotal pores* 3–4 (3·8). *Antespiracular dorsal pores* 5–9 (7·4) ; *post-tergital pores* 2–6 (4·4). Ventrally, 1–2 (1·8) *prosternal pores* occur medially.

Mesothorax : Prescutum subrectangular in dorsal view : 82–85 (84)μ long and 122–143 (134)μ wide, i.e. the ratio length to width 1 : 1·4–1·7 (1 : 1·6). *Prescutal ridge* strong and prescutal *suture* distinct. *Scutum* with heavily sclerotized anterolateral extremities and with a longitudinal median narrow membranous area. Scutum 98–116 (104)μ long, i.e. the ratio lengths of prescutum to scutum 1 : 1·2–1·4 (1 : 1·22). *Prealare, prealar ridge, triangular plate, tegula, anterior* and *posterior notal wing processes* well developed. *Scutellum* pentagonal, 58–67 (61)μ long and 98–116 (104)μ wide, the ratio length to width 1 : 1·6–1·7 (1·68), and the ratio its length to the length of scutum 1 : 1·6–1·7 (1·67). *Postalare* with well separated *anterior* and *posterior postalar ridges ; postnotal apophysis* strong. *Mesopleuron : Mesopleural ridge* interrupted above the coxal articulation ; *mesopleural apophysis, mesopleural wing process* and *basalare* well developed. The *mesepisternum* anteriorly bounded by the *subepisternal ridge ; lateropleurite* narrow ; *mesepimeron* small and heavily sclerotized. *Mesosternum : Basisternum* 137–156 (143)μ long and 180–204 (189)μ wide ; the *marginal* and *precoxal ridges*, as well as the *furca* strongly developed. *Mesothoracic spiracles* 18–21 (20)μ wide at opening, with 31–40 (35)μ long supporting bar. *Mesothoracic setae* on each side of the median line : *Prescutal setae* 3–4 (3·8) ; *scutal setae* 8–10 (9·4) ; *scutellar setae* 2–4 (2·8). *Tegular setae* 2–3 (2·6) ; *postmesostigmatal setae* 4–5 (4·4) in a lateral group behind each spiracle. *Basisternal setae* 10–13 (11·8). *Mesothoracic disc pores :* 2–4 (3·0) *mesospiracular pores* present behind each spiracle ; *postmesostigmatal pores* absent.

Metathorax : Metapostnotal sclerites well developed and *metapostnotal ridge* distinct. *Metapleural ridge* provides a small *metapleural apophysis* near the middle ; *metapleural wing process*, small. *Precoxal ridge, metepisternum, metepimeron* and *metasternal apophysis* well developed. *Metathoracic spiracle* identical with that of the mesothorax. *Metathoracic setae* on each side : *Metatergal setae* 3–5 (4·0), in a sublateral group ; *metapleural setae* absent. *Anterior metasternal setae* 4–6 (5·0) ; *posterior metasternal setae* 0–2 (1·0). *Metathoracic pores* on each side : *Metaspiracular pores* 2–3 (2·4) ; *anterior metasternal pores* 3–4 (3·4) ; and *posterior metasternal pores* also 3–4 (3·5).

Wings : 854–924 (896)μ long and 308–364 (336)μ wide ; *axillary* and *additional sclerites* well developed. 3 *alar setae* and 2 *circular sensoria* always present. *Hamulohalterae* 67–73 (70)μ long and 15–18 (17)μ wide ; with a slender *ridge* and an apically hooked seta, 40–46 (43)μ long (the ratio its length to the length of the hamulohaltera 1 : 1·6–1·7 (1·64).

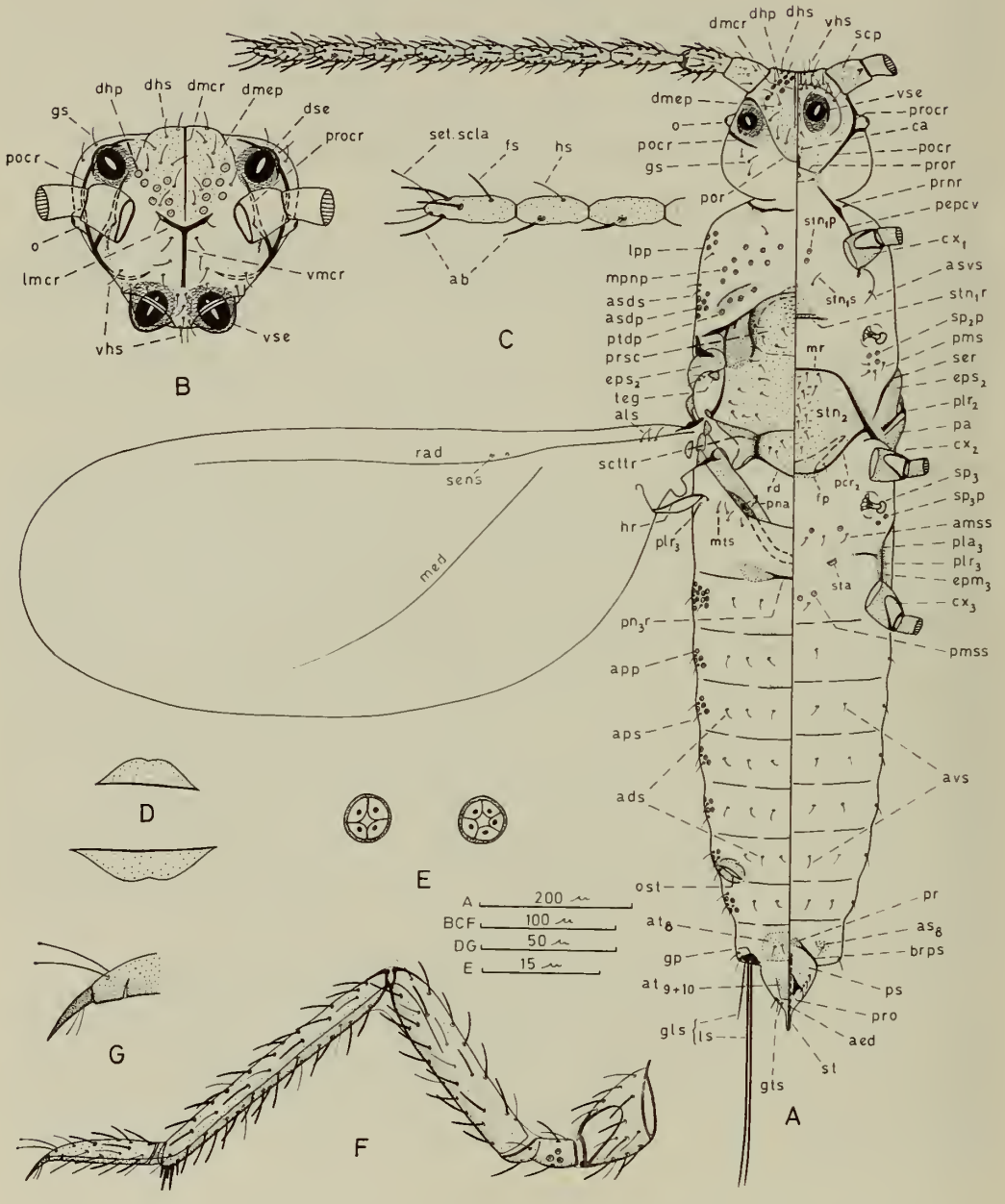


FIG. 7. *Planococcus dioscoreae* Williams, dorsal and ventral view.

Legs : Comparatively long and moderately stout ; the ratio length of the hind leg to the total length of the body about 1 : 1·9. *Coxa* about 49 and *trochanter* about 30μ wide. *Femur* about 43μ wide ; that of the fore leg shortest and that of the hind leg longest ; the ratio width to length of hind femur 1 : 4·5–5·2 (4·9). *Tibia* about 24μ wide ; with 2 apical stout spurs and 2–4 smaller spines ; the ratio length of femur to tibia in fore leg being 1 : 1·1. *Tarsus* about 21μ wide ; *tarsal digitules* apically knobbed, about 34μ long. *Claw* gradually tapering to a sharp point ; *ungual digitules* extremely fine. The lengths of the leg segments and the number of setae on each are given in the following table, in microns :

		Fore leg	Middle leg	Hind leg
Coxa	length	40–46 (43)	40–46 (43)	43–49 (46)
	f.s.	8–12 (10·0)	9–11 (10·0)	10–13 (11·5)
	h.s.	4–6 (5·0)	5–7 (6·0)	5–8 (6·5)
Trochanter	length	64–73 (70)	64–73 (70)	67–76 (73)
	f.s.	3–4 (3·5)	2–4 (3·0)	3–4 (3·5)
	h.s.	0–1 (0·5)	1–2 (1·5)	1–2 (1·5)
Femur	length	168–189 (180)	171–189 (180)	180–207 (195)
	f.s.	16–23 (19·5)	19–25 (22)	22–32 (27)
	h.s.	7–10 (8·5)	9–11 (10·0)	7–10 (8·5)
Tibia	length	183–204 (195)	198–217 (207)	250–268 (259)
	f.s.	32–38 (35)	33–40 (36·5)	46–51 (48·5)
	h.s.	6–9 (7·5)	6–10 (8·0)	7–11 (9·0)
Tarsus	length	76–85 (82)	79–85 (82)	92–98 (95)
	f.s.	9–12 (10·5)	9–11 (10·0)	11–14 (12·5)
	h.s.	8–10 (9·0)	7–10 (8·5)	9–12 (10·5)
Claw	length	27–31 (29)	27–31 (29)	27–31 (29)
Total length of leg		558–628 (592)	580–641 (610)	659–729 (695)

Abdomen : 471–532 (502)μ long and 274–319 (296)μ wide. Tergites of segments I and II small ; that of segment VIII large and that of segments 9 + 10 distinct. Sternites of segment VIII small and weak. *Ostioles* prominent and well developed, 37–46 (40)μ long at orifice. *Abdominal setae* on each side : *Dorsal setae* on segments I to VIII usually 2–3 and occasionally 4. *Pleural* setae 2–4, including one slightly longer seta on segment VIII. *Ventral setae* 1

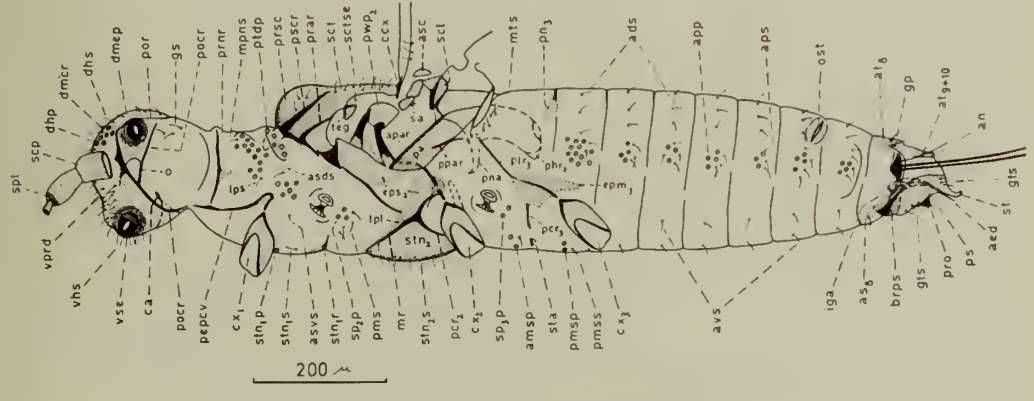


FIG. 8. *Planococcus dioscoreae* Williams, lateral view.

on segment II and 2 on segments III to VIII. *Abdominal disc pores :* Segment I with 10–17 (13·5), and segments II to VII with 3–5 *pleural pores ; dorsal* and *ventral abdominal pores* absent.

Glandular pouch well developed ; *setae of glandular pouch* consist of the two long *tail setae*, 305–320 (314)μ long, and one much shorter seta, 55–92 (73)μ long ; the ratio length of the tail setae to the total length of the body 1 : 4·1–4·4 (1 : 4·2).

Genital Segment : Comparatively small : triangular in dorsal view ; *style* short, curving upwards in lateral view. *Penial sheath* 122–128 (125)μ long and about 76μ wide, i.e. the ratios its length to its width about 1·6 : 1, and its length to the total body length 1 : 10·2–10·9 (1 : 10·6). *Basal ridge of penial sheath* well developed, with a small *projection. Process of penial sheath* well pronounced, with 3–4 (3·6) minute *setal sensilla. Aedeagus* gradually tapering to a sharply pointed tip. *Setae of genital segment* on each side : Dorsally, 3 setae always present near the base of the style ; *ventrally* 4–5 (4·5) setae occur on the penial sheath.

Material examined : 3 specimens only of this species were available for study, collected by H. Standfast, on Yam (*Dioscorea* sp.), in Sepik district, Tenteguna, New Guinea, on 23.vi.1959 (received from D. J. Williams).

PLANOCOCCOIDES Ezzart & McConnell, 1956

Planococcoides ireneus De Lotto

(Text-figs. 9, 10)

Winged forms only known ; living specimens not available. The males narrow and slender, of medium size, with comparatively short antennae and moderately long legs. When mounted, total body length 1008–1414 (1162)μ, width at mesothorax 280–350 (322)μ and wing expanse 1932–2422 (2114)μ.

Body setae and *pores :* The appendages clothed with many fleshy and few hair-like setae, about 39μ long ; the body itself with hair-like setae only, about 24μ long. Numerous quadrilocular and occasionally quinquelocular disc pores, about 9μ in diameter, occur on the head, the thorax and the abdomen.

Head : Subtetrahedron ; subtriangular in dorsal and front views ; *ventral preocular depression* hardly indicated in lateral view. Length from apex to postoccipital ridge 98–122 (113)μ ; from apex to neck 153–180 (165)μ ; width across genae 174–214 (192)μ. *Dorsal arm of midcranial ridge* slender, anteriorly detached from other arms and posteriorly reaching the posterior level of the dorsal eyes. *Ventral* and *lateral arms of midcranial ridge* well developed, forming together a Y-shaped ridge. *Postoccipital ridge* anteriorly separated from the preocular ridges. *Dorsomedial part of epicranium* (dmep) slightly raised. *Preocular + interocular ridges* meet the *postocular ridge* below the ocellus ; ventral rudiment of the former entirely absent. *Preoral ridge* slender. *Genae* large. *Eyes : Dorsal simple eyes* not projecting beyond the outer margins of the head in dorsal view ; the diameter of their corneae 21–27 (24)μ, and separated by 79–101 (89)μ, i.e. 3·1–4·7 (3·6) times as much as their corneae apart. *Ventral simple eyes* 24–31 (29)μ in diameter and 18–40 (25)μ apart. *Lateral ocelli* well developed. *Ocular sclerite* traversed by the interocular ridge. *Cranial apophysis* truncate ; *tentorial bridge* slender. *Dorsal head setae* 8–11 (9·9) on each side of the median line ; each gena always with 3 *genal setae. Ventral head setae* on each side : 3–5 (3·9) between the ventral eyes ; 7–11 (7·7) in the area of the ventral preocular depression, forming a transverse band continuous with those of the other side ; 3–5 (4·3) anteriorly on each side of the ventral arm of the midcranial ridge. *Head disc pores :* 2–3 (2·4) *dorsal pores* present near the base of each antenna.

Antennae : Filiform ; normally 10-segmented but fusion between adjacent segments very common ; 494–580 (545)μ long, i.e. equal or slightly shorter than half the body length, the ratio 1 : 2·0–2·5 (1 : 2·1) ; somewhat shorter than the hind leg, the ratio 1 : 1·1–1·3 (1 : 1·2). *Scape* 31–40 (37)μ long and 40–46 (42)μ wide at base ; always with 5 hair-like setae. *Pedicel* 52–55 (54)μ long and 31–37 (34)μ wide ; with 12–77 (15·1) f.s., 5–10 (6·8) h.s. and a *sensillum placodeum*. *Flagellum :* Segment III club-shaped, usually the longest (sometimes equal in

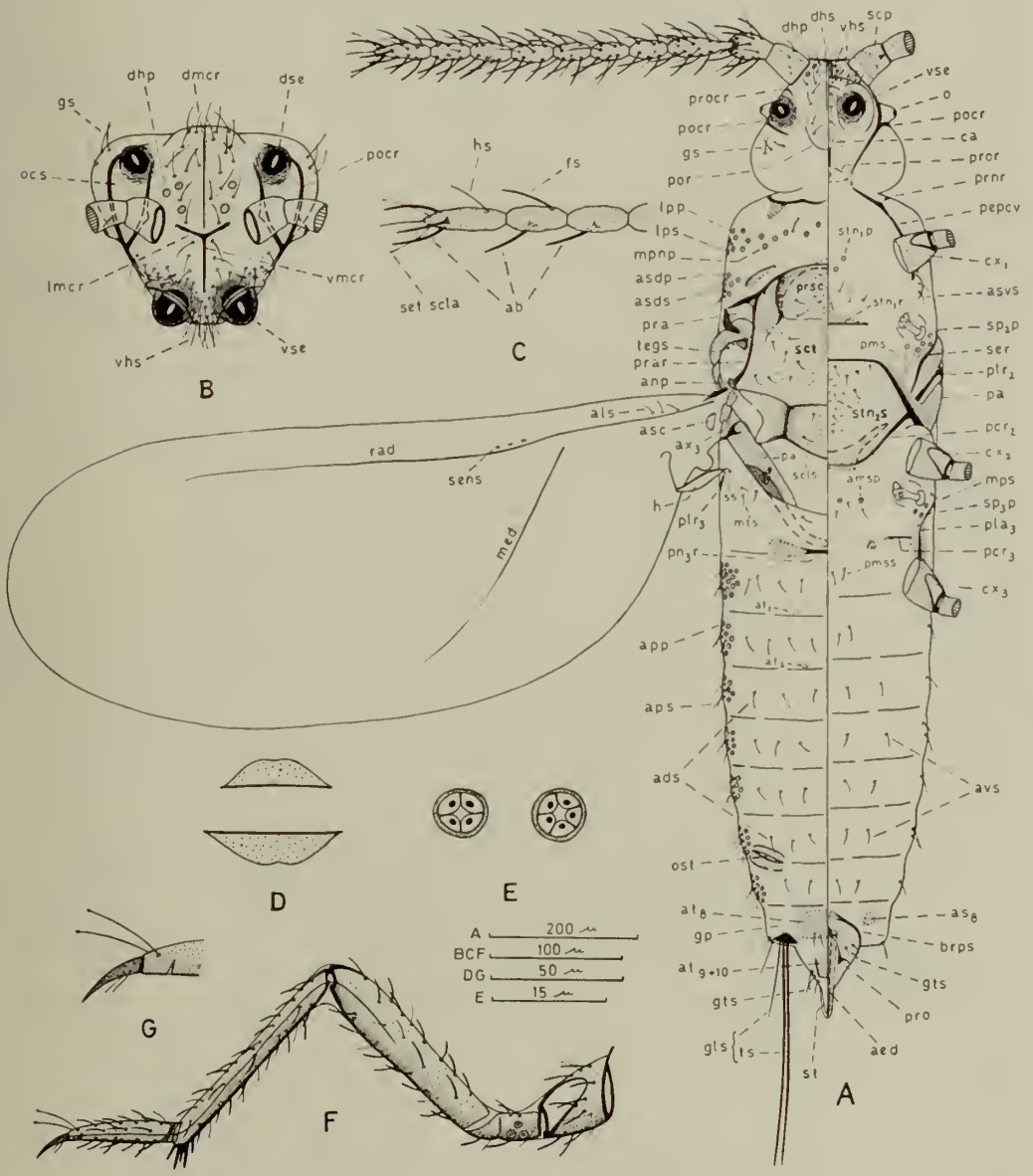


Fig. 9. *Planococcus ireneus* De Lotto, dorsal and ventral view.

length to terminal segment), the ratio length of segments III to X being 1·0–1·1 (1·05) : 1 ; segment III about 25μ wide, the ratio its width to its length being 1 : 2·6–3·3 (3·1). Segments IV–X cylindrical and about 23μ wide ; the ratio width to length of segment IX 1 : 2·9–3·6 (3·3). In the following table the length of the flagellar segments and the number of setae on each are given:

	III	IV	V	VI	VII	VIII	IX	X
length in μ	70–82	43–52	43–52	46–58	46–58	49–58	49–58	70–79
(av.)	(76)	(49)	(49)	(52)	(52)	(55)	(55)	(73)
f.s.	12–15	8–14	9–14	11–17	13–17	12–18	13–16	14–20
(av.)	(14·1)	(11·3)	(12·5)	(14·7)	(15·4)	(14·8)	(14·7)	(18·3)
h.s.	2–5	1–3	0–2	0–2	0–1	0–1	0–1	0–2
(av.)	(3·9)	(2·0)	(1·1)	(0·7)	(0·4)	(0·7)	(0·7)	(0·8)

Antennal bristles : Each of antennal segments VIII and IX with one ventral bristle. Terminal segment with 3 preapical bristles the dorsal of which is slightly shorter ; terminal segment also with two capitate *subapical sensory setae* and one apical hair-like seta.

Thorax : 395–578 (464)μ long. *Prothorax : Pronotal ridges* medially interrupted ; *lateral pronotal sclerites* small. *Post-tergites* of medium size. *Proepisternum* with ridge-like dorsal margin ; *propleural ridge* short and *propleural apophysis* small. *Prosternum* subtriangular, narrow medially, and 37–43 (39)μ long ; with a transverse, 85–101 (89)μ long *prosternal ridge Prothoracic setae* on each side : One *medial pronotal seta* usually present, but two setae may occasionally occur (av. 1·1) ; *lateral pronotal seta* 0–1 (0·6) ; *post-tergital setae* absent. *Antespiracular dorsal setae* 3–5 (3·7) and *antespiracular ventral setae* 1–2 (1·2). *Prosternal setae* 2–3 (2·5). *Prothoracic disc pores* on each side : *Medial pronotal pores* 4–10 (6·3) and *lateral pronotal pores* 3–11 (5·6) ; these two groups sometimes become rather difficult to separate. *Antespiracular dorsal pores* 4–8 (5·5) ; *post-tergital pores* absent. *Prosternal pores* 1–3 (1·6) forming with those of the other side a median group.

Mesothorax : Prescutum subrectangular in dorsal view ; 64–76 (70)μ long and 116–137 (125)μ wide, the ratio being 1 : 1·6–2·0 (1 : 1·8) ; *prescutal ridges* well developed and *prescutal suture* well marked. *Scutum* with well sclerotized anterolateral extremities, and with a longitudinal median narrow membranous area. Scutum 95–119 (101)μ long, i.e. the ratio length of prescutum to scutum 1 : 1·3–1·8 (1·4). *Prealare, prealar ridge, triangular plate* and *tegula* well developed. *Scutellum* pentagonal in dorsal view ; 55–70 (58)μ long, and 98–125 (107)μ wide, the ratio being 1 : 1·7–1·9 (1 : 1·8), and the ratio its length to the length of scutum 1 : 1·6–1·8 (1 : 1·7). *Postalare* with well separated *anterior* and *posterior postalar ridges. Postnotal apophysis* strong. *Mesopleuron : Mesopleural ridge* interrupted above the coxal articulation ; *basalare* well developed. *Mesepisternum* semimembranous ; *lateropleurite* narrow ; *mesepimeron* well sclerotized. *Mesosternum : Basisternum* 122–143 (128)μ long and 183–229 (195)μ wide ; *marginal, precoxal ridges* and *furca* well developed. *Mesothoracic spiracles* 18–24 (21)μ wide at opening, and with a 37–46 (43)μ long supporting bar. *Mesothoracic setae* on each side : *Prescutal setae* 1–2 (1·7) ; *scutal setae* 7–10 (8·1) ; *scutellar setae* usually 2 and occasionally 3 (av. 2·1) ; *tegular setae* 2–3 (2·2). *Postmesostigmatal setae* 3–5 (4·3), in a latero-ventral group behind the spiracle ; *basisternal setae* 7–11 (9·2). *Mesothoracic disc pores : Mesospiracular pores* comparatively numerous, 4–7 (5·1) posteriorly associated with each spiracle.

Metathorax : Metapostnotal sclerites and *metapostnotal ridge* well developed. *Metapleural ridge* with the usual attenuation near the middle at the point of origin of the *metapleural apophysis ; metapleural wing process* small. *Precoxal ridge of metathorax, metepisternum* and *metepimeron* distinct ; *metasternal apophysis* small. *Metathoracic spiracles* identical with the mesothoracic. *Metathoracic setae* on each side : *Metatergal setae* always include a group of 3 sublateral setae, and one isolated submedially ; one *metapleural seta* usually present. *Anterior metasternal setae* 2–4 (3·1) ; *posterior metasternal setae* 1–3 (1·9). *Metathoracic disc pores* on each side : *Metaspiracular pores* 2–4 (2·6) ; *anterior metasternal pores* 1–2 (1·5) ; *posterior metasternal pores* absent.

Wings : 854–1050 (924)μ long, and 322–434 (364)μ wide ; usually with 3 *alar setae* (occasionally 2, av. 2·9(, and 3–4 (3·3) *circular sensoria*. *Hamulohalterae* 64–73 (70)μ long, and 12–18 (15)μ wide ; with a weak slender ridge and one, apically hooked, 52–58 (55)μ long seta ; i.e. the ratio length of seta to the length of the hamulohaltera 1 : 1·2–1·4 (1 : 1·3).

Legs : Moderately long ; the fore legs shortest, and the hind legs longest ; the ratio length of the hind leg to the total body length 1 : 1·8–2·1 (1 : 1·9). *Trochanter* about 24μ wide. *Femur* about 40μ wide, the ratio width to length of hind femur 1 : 4·2–5·0 (4·5). *Tibia* about 24μ wide, with 2 strong apical spurs and 2–4 smaller spines ; the femur in front leg longer than the tibia, the ratio their lengths being 1·01–1·4 (1·1) : 1. *Tarsus* about 21μ wide ; *tarsal digitules* apically knobbed, about 34μ long. *Claw* uniformly tapering to a sharply pointed apex ; *ungual digitules* finely pointed. The following table shows the lengths of the leg segments (in microns) and the number of setae on each:

		Fore leg	Middle leg	Hind leg
Coxa	length	37–43 (40)	37–48 (40)	43–52 (46)
	f.s.	6–11 (9·0)	8–14 (9·6)	9–17 (12·0)
	h.s.	3–7 (4·3)	3–6 (4·1)	4–7 (5·0)
Trochanter	length	61–67 (62)	61–67 (64)	67–73 (70)
	f.s.	3–5 (4·4)	3–7 (4·7)	4–10 (6·3)
	h.s.	1–3 (2·0)	1–2 (1·3)	1–4 (2·4)
Femur	length	153–174 (162)	156–177 (168)	165–198 (180)
	f.s.	17–24 (20·1)	16–26 (20·9)	20–29 (24·6)
	h.s.	3–6 (3·9)	3–6 (4·3)	3–6 (4·1)
Tibia	length	137–162 (153)	153–183 (168)	189–217 (204)
	f.s.	21–30 (25·6)	24–32 (26·1)	33–40 (35·6)
	h.s.	3–5 (3·6)	3–5 (4·0)	3–6 (4·3)
Tarsus	length	73–79 (76)	73–79 (76)	76–82 (79)
	f.s.	18–23 (20·3)	16–23 (19·4)	19–26 (21·6)
	h.s.	0–2 (1·0)	0–2 (0·9)	0–3 (1·0)
Claw	length	37–46 (40)	37–46 (40)	37–46 (40)
Total length of leg		503–570 (534)	519–598 (555)	577–665 (619)

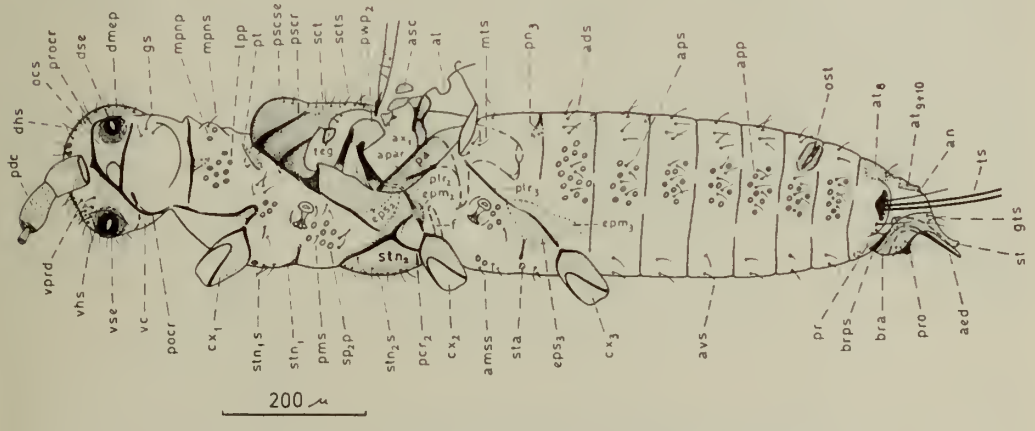


FIG. 10. *Planococcus ireneus* De Lotto, lateral view.

Abdomen : 380–562 (448)μ long and 281–342 (319)μ wide. Tergites of segments I, II and III small ; those of segments VIII and IX + X large. The sternites of segment VIII distinct. *Ostioles* well developed, with a 52–61 (55)μ long orifice. *Abdominal setae* on each side : *Dorsal setae* 2–4 on segments I to VII, and always 2 on segment VIII. *Pleural setae* 3–5 on segments I to VIII, including one conspicuously longer seta on the latter. *Ventral setae* 1–2 on segment II, 2–3 on segment III, always 2 on segments IV to VII, and absent on segment VIII. *Abdominal disc pores :* Segments I to VII with 9–23 (14·1), 4–11 (7·4), 4–11 (7·4), 5–10 (6·7), 5–10 (6·9) 4–9 (7·3), and 5–12 (7·8) *pleural pores*, respectively.

Setae of glandular pouch include two, 275–305 (290)μ long *tail setae*, and one, 79–107 (92)μ long seta ; the ratio length of the tail setae to the total length of the body 1 : 3·7–4·6 (4·0).

Genital segment : Conical in dorsal view, extending posteriorly into a tubular, apically rounded style ; the latter slightly curving upwards in lateral view. *Penial sheath* 113–134 (122)μ long and 85–98 (89)μ wide, i.e. the ratio 1·3–1·5 : 1 (1·4 : 1), and the ratio its length to the total body length 1 : 8·9–10·6 (1 : 9·5). *Basal ridge of penial sheath* with a small internal *projection ; process of penial sheath* well developed, with 3–4 (3·6) *setal sensilla*. *Aedeagus* tapering to a pointed end ; *internal genital aperture* large. *Setae of genital segment* slightly smaller than the other body setae ; the dorsal always includes 3 h.s. on each side, near the base of the style ; the ventral group consists of 3–4 (3·4) h.s. on each side of the penial sheath.

Material : 10 specimens examined, collected by D. N. McNutt, on roots of *Coffea arabica*, in Buwagogo, Uganda, 23.viii.1961.

NIPAECOCCUS Šulc, 1945

Nipaecoccus vastator (Maskell)

(Text-figs. 11, 12)

Only the winged males known. A slender species, of medium size, with moderately long antennae and legs. Mounted specimens 1148–1358 (1246)μ long, 280–322 (294)μ wide and 2310–2660 (2520)μ wing expanse.

Body setae and *disc pores :* The antennae with fleshy and hair-like setae, approximately 37μ long ; the body itself and the legs with hair-like setae only, about 28μ long. Quadrilocular and occasionally quinquelocular disc pores, about 6μ in diameter, occur on the head, thorax and abdomen ; Beardsley (1960) observed few pores with 6 peripheral oculi.

Head : Subtetrahedron ; subtriangular in dorsal and front views ; *ventral preocular depression* hardly indicated in lateral view. Length from apex to postoccipital ridge 107–131 (116)μ ; from apex to neck 177–198 (186)μ ; width across the genae 207–244 (229)μ. *Dorsal arm* of midcranial ridge anteriorly detached from other arms by a short distance, and posteriorly meeting the postoccipital ridge ; *ventral* and *lateral arms* forming a T-shaped ridge. *Postoccipital ridge* U-shaped and anteriorly continuous with the preocular ridges. *Dorsomedial part of epicranium* weakly sclerotized. *Preocular + interocular ridges* posteriorly joined to *postocular ridge* below the ocellus ; *preocular ridge* without any apparent ventral rudiment. *Preoral ridge* slender. *Eyes : Dorsal simple eyes* project beyond the outer margins of the head in dorsal view ; their corneae 34–46 (40)μ in diameter and separated by 107–125 (113)μ, i.e. 2·5–3·5 (2·8) times as much as their diameter apart. *Ventral simple eyes* only 31–43 (37)μ in diameter, and separated by 27–40 (34)μ. *Lateral ocelli* large. *Cranial apophysis* apically truncate. *Tentorial bridge* slender. *Dorsal head setae* 10–14 (11·8), on each side of the median line ; each gena almost always with 3 genal setae (occasionally 2). *Ventral head setae* on each side as follows : 5–6 (5·4) between the ventral eyes ; 8–12 (10·1) forming on both sides a

transverse band across the area of the ventral preocular depression ; 4–6 (5·1) in a longitudinal row on each side anteriorly. *Head disc pores :* One *dorsal pore* always present near the base of each antenna. *Antennae :* Filiform ; 10-segmented ; 744–903 (821)μ long, i.e. longer than half the total length of the body (ratio 1 : 1·4–1·6, av. 1·5), and longer than the hind legs (ratio 1·2–1·4, av. 1·3 : 1). *Scape* 43–49 (46)μ long and 46–52 (49)μ wide at base ; usually with 4 h.s. (occasionally with 5 or 6, av. 4·2). *Pedicel* 58–73 (67)μ long and 40–46 (43)μ wide ; with 20–36 (27·2) f.s., 5–11 (7·6) h.s. and a *sensillum placodeum*. *Flagellum :* Segment III club-shaped ; subequal in length or somewhat shorter than the terminal segment (ratio 1 : 1–1·1, av. 1·03) ; about 31μ wide, i.e. the ratio its width to its length 1 : 2·8–3·4 (3·0). Segments IV to X cylindrical, and about 24μ wide, the ratio width to length of segment IX being 1 : 3–3·8 (3·4). The following table shows the lengths of the flagellar segments and the number of setae on each :

	III	IV	V	VI	VII	VIII	IX	X
length in μ	85–104	73–95	76–95	79–101	79–104	89–101	73–92	85–101
(av.)	(93)	(85)	(85)	(89)	(92)	(95)	(82)	(95)
f.s.	14–24	16–30	20–31	17–32	19–28	22–29	16–27	23–29
(av.)	(19·6)	(22·4)	(24·3)	(23·2)	(24·6)	(24·6)	(21·3)	(25·5)
h.s.	3–8	3–6	2–4	4–6	3–6	4–6	3–5	1–4
(av.)	(5·5)	(4·3)	(2·8)	(4·7)	(4·2)	(4·7)	(4·0)	(2·5)

Antennal bristles slightly stouter than the fleshy setae. One ventral bristle present on each of antennal segments VIII and IX. Terminal segment with 3 subapical bristles and 2 much smaller, lateroventral ones, at a greater distance from the apex. The segment also with two capitate *subapical sensory setae* and one apical, hair-like seta.

Thorax : 456–570 (524)μ long. *Prothorax : Pronotal ridges* with the usual interruption medially ; *lateral pronotal sclerites* and *post-tergites* distinct. *Proepisternum* with a ridge-like dorsal margin. *Prosternum* subtriangular, 37–52 (43)μ long ; *prosternal ridge* 92–113 (104)μ long. *Prothoracic setae* on each side of the median line : *Medial pronotal* and *lateral pronotal setae* 0–1 (av. 0·2 and 0·3 respectively) ; *post-tergital setae* absent ; *antespiracular dorsal setae* 2–4 (2·7). One *antespiracular ventral seta* always present. *Prosternal setae* 1–3 (1·9). *Prothoracic disc pores* on each side : *Medial pronotal pores* 1–3 (1·9) ; *lateral pronotal pores* 1–3 (2·1) ; *antespiracular dorsal pore* always one. *Prosternal pores* usually one, but sometimes either side may be with 2 pores or none at all (av. 0·9).

Mesothorax : Prescutum 70–95 (79)μ long and 110–134 (122)μ wide (ratio 1 : 1·4–1·7, av. 1·5). *Prescutal ridges* well developed and *prescutal suture* distinct. *Scutum* with heavy antero-lateral sclerotizations, and with a medial longitudinal narrow membranous area ; 89–113 (104)μ long, i.e. the ratio lengths of prescutum to scutum 1 : 1·1–1·4 (1·3). *Prealare, prealar ridge* and *triangular plate* well developed. *Scutellum* 49–64 (58)μ long and 85–104 (98)μ wide, i.e. the ratios its length to its width 1 : 1·6–1·9, av. 1·7, and its length to the length of the scutum 1 : 1·6–2, av. 1·8. *Postalare* with well separated *anterior* and *posterior postalar ridges*. *Mesopleuron : Mesopleural ridge* interrupted above the coxal articulation ; *basalare* strong. Other pleural structures typical of the family. *Mesosternum : Basisternum* 122–153 (137)μ long and 171–214 (189)μ wide ; *marginal* and *precoxal ridges* strong. *Mesothoracic spiracle* 18–21 (20)μ wide at opening, with 40–46 (43)μ long supporting bar. *Mesothoracic setae* on each side : *Prescutal setae* 3–5 (3·6) ; *scutal setae* 7–11 (8·1) ; *scutellar setae* 2–4 (2·8). *Tegular setae* 4–6 (4·9). *Postmesostigmatal setae* 5–8 (5·9), occurring in a lateral group behind each spiracle. *Basisternal setae* 6–9 (7·3). *Mesothoracic disc pores :* 1–2 (1·2) *mesospiracular pores*, and 0–1 (0·9) *postmesostigmatal pores* present on each side of the median line.

Metathorax : Metapostnotal sclerites and *metapostnotal ridge* well developed. *Pleural ridge* attenuated near the middle, where a *pleural apophysis* originates ; *pleural wing process* small. *Episternum, epimeron, precoxal ridge* and *metasternal apophysis* distinct. *Metathoracic spiracle* similar to the mesothoracic one. *Metathoracic setae* on each side : *Metatergal setae* 2–5 (2·6) ;

metapleural setae usually absent, but one seta may occasionally occur on one side (av. 0·2). *Anterior metasternal setae* 1–3 (1·9) ; *posterior metasternal setae* 1–2 (1·3). *Metathoracic disc pores* on each side : *Metaspiracular pores* 2–3 (2·2) ; *anterior metasternal pores* 0–2 (0·9), and *posterior metasternal pores* 0–2 (1·0).

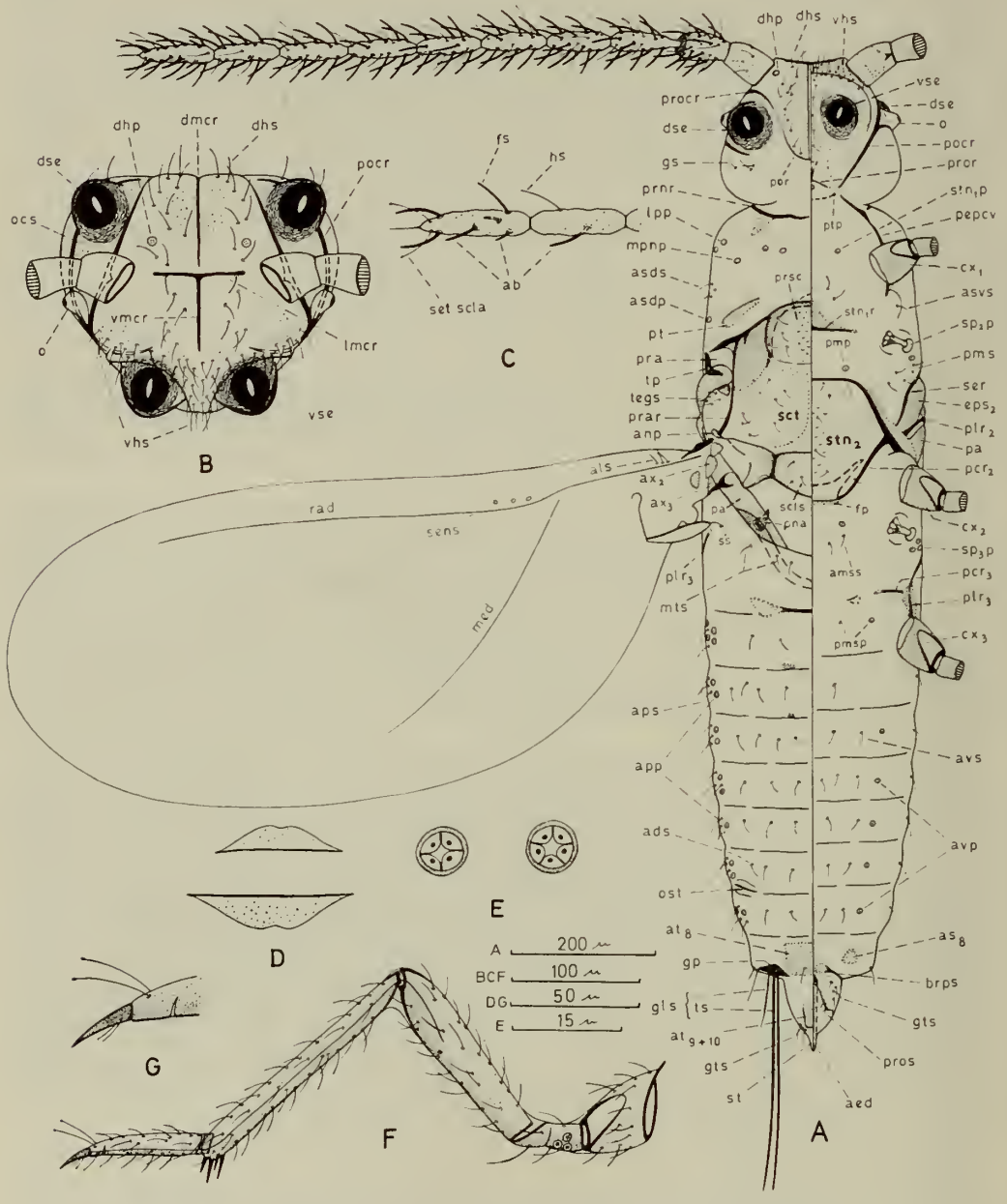


FIG. 11. *Nipaecoccus vastator* (Maskell), dorsal and ventral view.

Wings : 980–1120 (1050)μ long and 378–448 (406)μ wide. *Alar lobe*, *axillary* and *additional sclerites* well developed. *Alar setae* usually 3, but 2 or 4 may occur (av. 2·9) ; with 3 *circular sensoria* in a compact row. *Hamulohalterae* 76–92 (80)μ long and 15–18 (17)μ wide ; with a 58–67 (61)μ long apically hooked seta, i.e. the ratio lengths of seta to hamulohaltera 1 : 1·2–1·4 (1·3).

Legs : Moderately long and slender ; the ratio length of the hind leg to the total length of the body 1 : 1·9–2·1 (2·0). *Coxa* and *trochanter* about 55 and 27μ wide respectively ; the latter with a long *apical seta*. *Femur* about 40μ wide ; that of the middle leg shortest ; the ratio width to length of hind femur 1 : 4·3–5·1 (4·7). *Tibia* about 23μ wide, with 2 apical strong spurs and 3–5 smaller spines ; the ratio lengths of femur to tibia in front leg 1 : 1–1·1 (1·04). *Tarsus* about 21μ wide and *tarsal digitules* about 40μ long. *Claw* gradually tapering towards a pointed end ; with a pair of finely pointed *ungual digitules*. The lengths of the leg segments (in microns), and the number of setae on each are given below :

		Fore leg	Middle leg	Hind leg
Coxa	lengths	40–46 (43)	40–49 (46)	43–52 (49)
	h.s.	9–14 (11·2)	10–15 (12·8)	10–16 (13·0)
Trochanter	lengths	58–67 (64)	58–67 (64)	61–70 (67)
	h.s.	4–7 (5·4)	4–6 (5·2)	4–7 (5·6)
Femur	lengths	156–183 (171)	146–177 (162)	156–186 (171)
	h.s.	28–41 (33·2)	22–36 (27·6)	25–40 (31·4)
Tibia	lengths	159–192 (177)	168–207 (186)	192–250 (220)
	h.s.	32–43 (36·4)	33–47 (38·8)	35–50 (42·3)
Tarsus	lengths	82–92 (85)	82–92 (85)	85–101 (92)
	h.s.	20–27 (23·6)	22–28 (24·6)	24–31 (26·6)
Claw	length	31–37 (34)	31–37 (34)	31–37 (34)
Total length of leg		522–613 (570)	522–628 (577)	567–689 (631)

Abdomen : 448–517 (479)μ long and 258–304 (281)μ wide. Tergites of segments I and II small, and those of segments VIII and IX + X distinct. A weak sternite on each side of segment VIII present. *Ostioles* ill-defined. *Abdominal setae* on each side : *Dorsal setae* 1–2

200 μ

FIG. 12. *Nipaecoccus vastator* (Maskell), lateral view.

on segment I, 2–4 on segments II to VII, and always 1 on segment VIII. *Pleural setae* 2–3 on segment I, 3–5 on segments II to VII, and always 3 on segment VIII, including one slightly longer seta. *Ventral setae* 1–2 on segment II, 2–3 on segments III to VII, and absent on segment VIII. *Abdominal disc pores* on each side : *Pleural pores* 2–4 on segment I and 1–3 on segments II to VII. One *ventral pore* usually also present on segments III to VII, but sometimes two occur on segments IV and VI, and sometimes the pores are absent on segment VII.

Glandular pouch well developed ; *glandular pouch setae* include a pair of 244–300 (268)μ long *tail setae*, and one, about 70μ long seta, i.e. the ratio length of the tail setae to the total length of the body 1 : 4·2–5·2 (4·6).

Genital segment small ; subtriangular in dorsal view ; *style* curving upwards in lateral view. *Penial sheath* 101–119 (107)μ long and 64–76 (70)μ wide (ratio 1·5–1·6, av. 1·52 : 1, and the ratio its length to the total body length 1 : 11·1–12·3, av. 11·6). *Basal ridge of penial sheath* its *projection* and the *process of penial sheath* well developed. *Aedeagus* tapering posteriorly towards a pointed tip. *Setae of genital segment* on each side : Dorsally 3 setae always present near the base of the style ; ventrally, 4–7 (5·4) setae occur on the penial sheath, and 3–4 (3·6) *setal sensilla* on its process.

Material : 10 specimens examined, collected by G. M. Das, in Cinnamara, Assam, India, during October, 1961 ; host plant not stated.

Nipaecoccus nipae (Maskell)

(Text-figs. 13, 14)

Macropterous forms only known. A narrow and slender species ; comparatively very small, with moderately long antennae and legs. When mounted 840–980 (896)μ long, 210–224 (214)μ wide and 1974–2240 (2086)μ wing expanse.

Body setae and *pores :* Fleshy and hair-like setae rather difficult to separate ; those occurring on the antennae about 31μ long and those on the legs slightly shorter ; the body itself only with hair-like setae, about 18μ long. Disc pores present on the head, thorax and abdomen ; these about 6μ in diameter, usually with 5 or 6, and occasionally 4 peripheral loculi.

Head : Subtetrahedron ; subtriangular in dorsal and front views ; *ventral preocular depression* hardly indicated in lateral view. Length from apex to postoccipital ridge 85–98 (92)μ ; from apex to neck 128–143 (137)μ ; width across the genae 162–177 (171)μ. *Dorsal arm of midcranial ridge* distinct, anteriorly separated from the other arms and posteriorly meeting the postoccipital ridge. *Lateral* and *ventral arms* forming a T-shaped ridge. *Postoccipital ridge* weakly developed and anteriorly confluent with the preocular ridges. *Dorsomedial part of epicranium* slightly raised. *Preocular + interocular ridges* joining *postocular* ridge below the ocellus ; ventral rudiment of *preocular ridge* absent. *Eyes : Dorsal eyes* not projecting beyond the outer margins of the head in dorsal view ; 18–21 (19)μ in diameter and separated by 79–89 (85)μ, i.e. 4·1–4·8 (4·6) times as much as their diameter apart. *Ventral eyes* 24–27 (26)μ in diameter and 18–21 (20)μ apart. *Lateral ocelli* well developed. *Ocular sclerites* weakly sclerotized. *Cranial apophysis* apically truncate. *Tentorial bridge* slender. *Dorsal head setae* 8–10 (8·8) on each side of the median line ; each gena always with 2 *genal setae*. *Ventral head setae* on each side : 4–5 (4·1) between the ventral eyes ; 9–13 (10·1) forming on both sides a transverse band in the area of the ventral preocular depression ; 2–3 (2·3) in a row on each side of the ventral arm of the midcranial ridge. The head also with 1–2 (1·3) *dorsal pores* on each side near the antennal base.

Antennae : Filiform ; 10-segmented ; 479–540 (509)μ long, i.e. somewhat longer than half

the length of the body (ratio 1 : 1·6–1·9, av. 1·8) and as long as, or slightly longer than the hind leg (ratio 1·0–1·1, av. 1·05 : 1). *Scape* 34–37 (36)μ long and 31–34 (33)μ wide at base ; always with 4 h.s. *Pedicel* 52–55 (54)μ long and 31μ wide ; with 14–21 (17·2) f.s., 8–11 (9·4) h.s. and a *sensillum placodeum*. *Flagellum :* Segment III club-shaped and about as long as segment X (ratio 1 : 1–1·1 (1·04)), both being the longest of all ; segment III about 20μ wide, i.e. the ratio its width to its length 1 : 2·7–3·0 (2·9). Segments IV to X cylindrical and about 18μ wide ; the ratio width to length of segment IX being 1 : 2·3–2·8 (2·5). The following table shows the lengths of the flagellar segments and the number of setae on each :

	III	IV	V	VI	VII	VIII	IX	X
length in μ	58–64	43–52	46–55	49–58	49–55	46–55	43–52	58–67
(av.)	(61)	(46)	(51)	(52)	(52)	(51)	(46)	(62)
f.s.	8–14	10–15	12–17	15–18	15–19	15–20	11–16	18–25
(av.)	(11·4)	(12·0)	(15·2)	(16·6)	(17·2)	(16·8)	(14·5)	(21·1)
h.s.	3–5	2–4	2–3	2–3	2–3	1–2	1–2	1–2
(av.)	(4·8)	(2·5)	(2·4)	(2·4)	(2·3)	(1·6)	(1·4)	(1·4)

Antennal bristles slightly stouter than the fleshy setae, and of subequal length ; segments VIII and IX each with one ventral bristle. Terminal segment with 3 preapical bristles, two capitate *subapical sensory setae* and one apical hair-like seta.

Thorax : 372–418 (395)μ long. *Prothorax : Pronotal ridges* medially interrupted at a weak point. *Lateral pronotal sclerites* and *post-tergites* small. Dorsal margin of *proepisternum* ridge-like. *Prosternum* subtriangular. anteriorly forming a weakly sclerotized ring ; 31–37 (34)μ long and posteriorly bounded by a transverse, 70–79 (76)μ long *prosternal ridge*. *Prothoracic setae* on each side : *Medial pronotal setae* 0–2 (1·1) ; *lateral pronotal* and *post-tergital setae* absent ; *antespiracular dorsal setae* 1–3 (1·2). One *antespiracular ventral seta*, and one *prosternal seta* always present. *Prothoracic disc pores* on each side : *Medial pronotal pores* 8–11 (9·6) ; *lateral pronotal pores* 2–3 (2·2) ; *antespiracular dorsal pores* 1–2 (1·2). One median *prosternal pore* usually present, but sometimes one pore occurs on each side of the median line (av. 0·8).

Mesothorax : Prescutum 67–76 (73)μ long and 82–92 (89)μ wide, the ratio being 1 : 1·2–1·3 (1·22). *Prescutal ridge* strong and *prescutal suture* distinct. *Scutum* heavily sclerotized antero-laterally, with a medial longitudinal narrow membranous area ; 70–76 (74)μ long, i.e. the ratio lengths of prescutum to scutum 1 : 1·0–1·1 (1·02). *Prealare, prealar ridge* and *triangular plate* well developed. *Scutellum* 34–40 (37)μ long and 64–73 (70)μ wide, i.e. the ratios its length to its width 1 : 1·8–2·1 (1·9), and its length to the length of scutum 1 : 1·9–2·3 (2·0). *Postalare* with well separated *anterior* and *posterior ridges*. *Mesopleuron : Mesopleural ridge* interrupted above the coxal articulation ; *basalare* stout and *subepisternal ridge* well developed. *Mesepisternum* and *mesepimeron* distinct ; *lateropleurite* narrow. *Mesosternum : Basisternum* 92–107 (102)μ long and 131–137 (135)μ wide ; *marginal* and *precoxal ridges* strong. *Mesothoracic spiracle* about 15μ wide at opening, with 31–34 (32)μ long supporting bar. *Mesothoracic setae* on each side ; *Prescutal setae* 2–3 (2·4) ; *scutal setae* 2–3 (2·6) ; *scutellar seta* 0–1 (0·6). *Tegular setae* 2–3 (2·2). *Postmesostigmatal setae* 2–3 (2·4), in a latero-ventral group. *Basisternal setae* 6–8 (6·6). *Mesothoracic disc pores : Mesospiracular pores* 1–2 (1·2) behind each spiracle ; *postmesostigmatal pores* always one.

Metathorax : Metapostnotal sclerites and *metapostnotal ridge* distinct. *Pleural ridge* attenuated near the middle where a small *pleural apophysis* originates, and dorsally supports the *wing process*. *Metepisternum* and *metepimeron* distinct. *Precoxal ridge* well developed and *metasternal apophysis* small. *Metathoracic spiracles* identical with those of mesothorax. *Metathoracic setae* on each side : *Metatergal setae* 1–2 (1·4) ; *metapleural setae* usually absent, although one seta was found in one specimen. *Anterior metasternal setae* absent, and *posterior metasternal seta* 0–1 (0·3). *Metathoracic disc pores : Metatergal* and *metaspiracular pores* missing ; *anterior* and *posterior metasternal pores* 1–2 (averages 1·1 and 1·3, respectively).

Wings : 840–952 (896)μ long and 322–378 (336)μ wide ; always with 3 *alar setae* and 2 minute *circular sensoria*. *Hamulohalterae* 55–61 (58)μ long and 12–15 (14)μ wide ; with a slender ridge and one apically hooked, 37–46 (41)μ long seta, i.e. the ratio lengths of the seta to the hamulohaltera 1 : 1·2–1·6 (1·4).

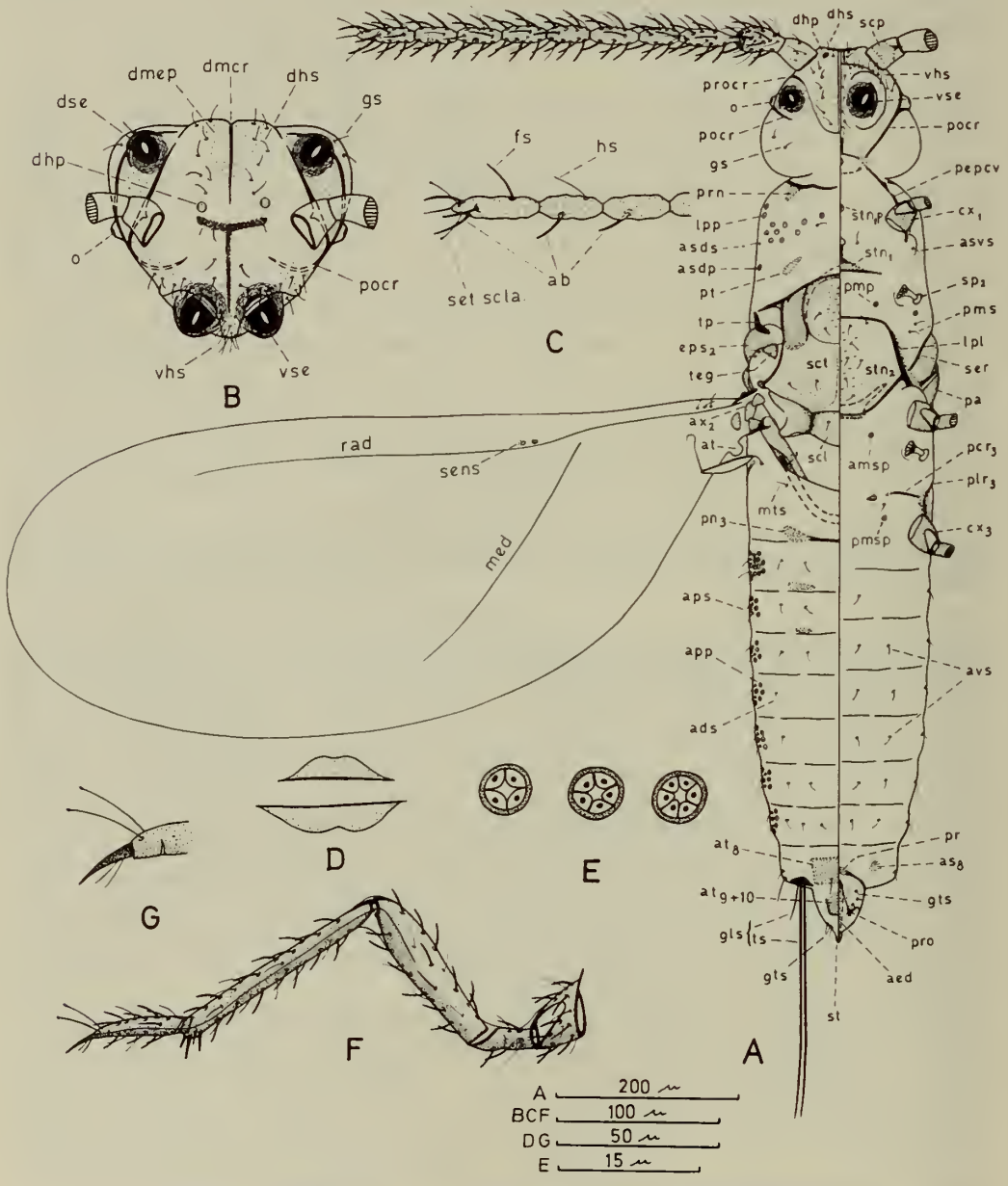


FIG. 13. *Nipaecoccus nipae* (Maskell), dorsal and ventral view.

Legs : Comparatively long and slender ; the ratio length of the hind leg to the total length of the body 1 : 1·8–1·9 (1·84). *Coxa* and *trochanter* about 37 and 18μ wide respectively. *Femur* about 27μ wide ; that of the middle leg shortest and that of the hind leg longest ; the ratio width to length of the hind femur 1 : 4·7–5·2 (5·0). *Tibia* about 18μ wide ; with 2 apical spurs and 2–4 smaller spines ; the ratio length of femur to length of tibia in the front leg 1 : 1·0–1·1 (1·03). *Tarsus* about 16μ wide ; *tarsal digitules* apically knobbed, about 31μ long. *Claw* gradually tapering to a sharply pointed apex ; *ungual digitules* extremely fine. The following table shows the lengths of the leg segments (in microns) and the number of setae on each :

		Fore leg	Middle leg	Hind leg
Coxa	length	24–27 (26)	24–27 (26)	27–31 (29)
	f.s.	7–10 (8·7)	7–11 (9·6)	9–12 (10·3)
	h.s.	4–6 (5·1)	4–6 (4·9)	4–7 (5·6)
Trochanter	length	46–49 (48)	46–49 (48)	49–52 (51)
	f.s.	2–4 (2·9)	2–4 (2·5)	2–5 (3·1)
	h.s.	3–4 (3·7)	2–4 (3·4)	3–4 (3·7)
Femur	length	125–137 (131)	119–131 (125)	131–143 (137)
	f.s.	18–23 (20·4)	15–19 (16·9)	16–21 (19·5)
	h.s.	6–9 (7·2)	5–7 (6·1)	5–8 (7·0)
Tibia	length	125–140 (134)	137–146 (143)	162–183 (171)
	f.s.	19–28 (24·4)	21–29 (26·7)	24–32 (28·2)
	h.s.	6–9 (7·6)	7–10 (7·8)	7–11 (8·1)
Tarsus	length	55–58 (57)	55–58 (57)	61–67 (63)
	f.s.	12–16 (13·6)	11–16 (12·9)	13–18 (15·1)
	h.s.	4–6 (5·2)	4–6 (4·9)	4–7 (5·8)
Claw	length	31–36 (34)	31–36 (34)	31–36 (34)
Total length of leg		418–442 (427)	424–445 (433)	470–512 (485)

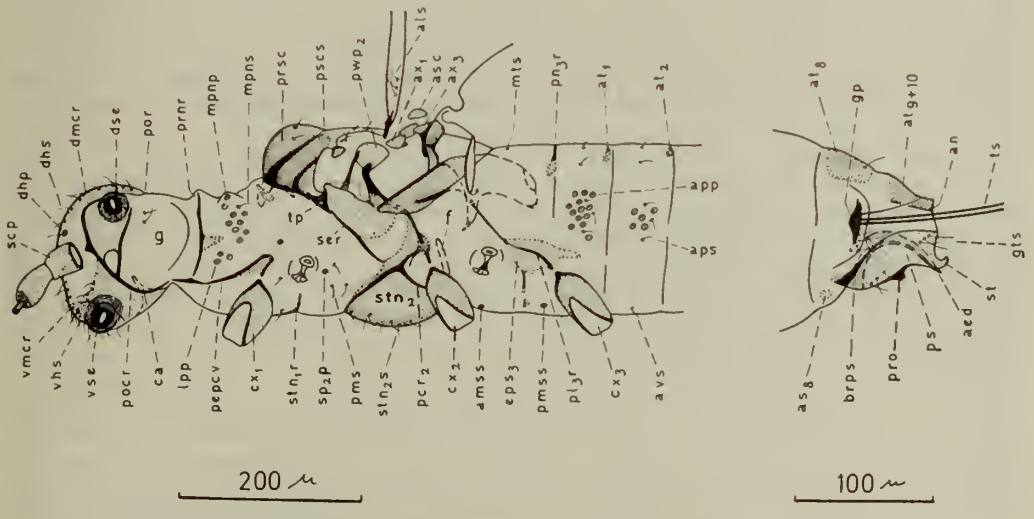


FIG. 14. *Nipaecoccus nipae* (Maskell), lateral view.

Abdomen : 274–357 (312)μ long and 198–213 (205)μ wide. A small tergite on each side of segments I and II present ; tergites of segments VIII and IX + X large. A weak sternite on each side of segment VIII present. *Ostioles* entirely absent. *Abdominal setae* on each side : *Dorsal setae* 1–3 on segments I to VIII. *Pleural setae* usually 3 on segments I to VIII (sometimes 2 setae occur on segment I, and 4 on segment III) ; pleural setae of segment VIII include a slightly longer seta. *Ventral setae* always 1 on segment II, 2 on segments III to VII, and absent on segment VIII. *Abdominal disc pores :* Segments I to VII with 10–15 (12·2), 4–5 (4·5), 4–6 (4·8), 4–7 (5·3), 4–7 (5·2), 4–7 (4·9), and 4–6 (5·1) *pleural pores* respectively.

Setae of glandular pouch consist of a pair of *tail setae*, 238–259 (250)μ long, and one, 37–46 (40)μ long seta, the ratio length of the tail seta to the total length of the body being 1 : 3·2–3·9 (3·6).

Genital segment small ; subtriangular in dorsal view. *Style* curving upwards in lateral view. *Penial sheath* 76–82 (79)μ long and 55–61 (58)μ wide, the ratio being 1·3–1·5 (1·4) : 1, and the ratio its length to the total body length 1 : 10·4–11·5 (11·2). *Basal ridge of penial sheath* with a small *projection* ; *process of penial sheath* well pronounced. *Aedeagus* gradually tapering towards a pointed tip. *Setae of genital segment :* Dorsally 3 setae always present on each side near the base of the style ; ventrally 3–4 (3·3) setae occur on each side of the penial sheath, and 3–4 *setal sensilla* on its process.

Material : 10 specimens examined, collected by J. Munting, on Palm, in Durban, South Africa, 1.x.1963.

MACONELLICOCCUS Ezzat, 1958

Maconellicoccus hirsutus (Green)

(Text-figs. 15, 16)

Macropterous forms only known ; living specimens light brown or yellowish. The males narrow and slender, of medium size, with comparatively short antennae and moderately long legs. Mounted specimens 1022–1428 (1232)μ long, 252–322 (294)μ wide and 1708–2310 (2016)μ wing expanse.

Body setae and *disc pores :* Antennae and legs with many fleshy and few hair-like setae, about 21μ long ; body itself with only somewhat shorter hair-like setae. Quadrilocular and occasionally trilocular or quinquelocular pores present on the head, thorax and abdomen.

Head : Subtetrahedron ; subtriangular in dorsal and front views ; *ventral preocular depression* hardly pronounced in lateral view. Length from apex to postoccipital ridge 113–134 (125)μ ; from apex to neck 153–192 (174)μ ; width across the genae 186–226 (214)μ. *Dorsal arm of midcranial ridge* anteriorly detached from the other arms, and posteriorly meeting the postoccipital ridge. *Lateral arms* forming with the *ventral arm* a Y-shaped ridge. *Postoccipital ridge* with a sclerotized area at its medio-posterior base ; anteriorly confluent with preocular ridges. *Dorsomedial part of epicranium* slightly raised. *Preocular* and *interocular ridges* join the *postocular ridge* below the ocellus ; preocular ridge without any ventral rudiment. *Eyes : Dorsal simple eyes* slightly projecting beyond the outer margins of the head in dorsal view ; their corneae 24–37 (31)μ in diameter, and separated by 104–128 (119)μ, i.e. 3·3–4·4 (3·7) times their corneae apart. *Ventral simple eyes* 27–40 (34)μ in diameter and 21–31 (28)μ apart. Lateral *ocelli* well developed. *Ocular sclerites* weakly sclerotized. *Cranial apophysis* with truncate apex. *Tentorial bridge* slender. *Dorsal head setae* 12–16 (13·4) on each side of the median line ; each gena usually with 3–4, and occasionally 5 *genal setae* (av. 3.3). *Ventral head setae* on each side : 1–2 (1·9) between the ventral eyes ; 13–16 (14·1) forming on both sides a transverse band across the area of the preocular depression ; 2–3 (2·2) anteriorly on

each side of the ventral arm of the midcranial ridge. *Dorsal head pores* 1–2 (1·2) near the base of each antenna.

Antennae : Filiform ; normally 10-segmented ; 470–653 (573)μ long, i.e. as long as, or shorter than half the total length of the body (ratio 1 : 2·0–2·3, av. 2·2), and shorter than the hind leg (ratio 1 : 1·1–1·2, av. 1·17). *Scape* 40–49 (43)μ long and 37–46 (43)μ wide at base ; always with 4 h.s. *Pedicel* 55–67 (64)μ long and 31–40 (37)μ wide ; with 26–36 (31·7) f.s., 10–18 (12·3) h.s. and a *sensillum placodeum*. *Flagellum :* Segment III club-shaped and longest of all (the ratio lengths of segments III to X 1·2–1·4, av. 1·3 : 1) ; the segment about 23μ wide, i.e. the ratio its width to its length 1 : 2·9–3·8 (3·4). Segments IV to X cylindrical and about 21μ wide, the ratio width to length of segment IX being 1 : 2·1–3·3 (2·7). The lengths of the flagellar segments and the number of setae on each are given in the following table :

	III	IV	V	VI	VII	VIII	IX	X
length in μ	61–85	43–67	43–61	43–61	43–63	46–70	46–58	52–70
(av.)	(76)	(55)	(52)	(52)	(53)	(56)	(52)	(59)
f.s.	13–18	13–20	13–20	12–18	13–19	12–19	12–16	10–16
(av.)	(15·9)	(16·3)	(16·1)	(14·9)	(16·4)	(15·0)	(14·2)	(13·6)
h.s.	3–7	2–5	2–3	2–5	2–6	3–6	3–6	3–6
(av.)	(4·7)	(3·4)	(2·5)	(3·5)	(3·9)	(4·4)	(4·4)	(4·5)

Antennal bristles easily distinguishable ; segments VIII and IX each with one ventral bristle. Terminal segment with 3 preapical bristles, the dorsal of which is about half as long as the others ; the segment also with two capitate *subapical sensory setae* and one apical hair-like seta.

Thorax : 418–600 (540)μ long. *Prothorax : Pronotal ridges* medially constricted at a weak point. *Lateral pronotal sclerites* moderately large and *post-tergites* narrow. *Proepisternum* with a ridge-like dorsal margin. *Prosternum* triangular, 31–46 (38)μ long ; *prosternal ridge* 85–104 (96)μ long. *Prothoracic setae* on each side : *Medial pronotal setae* 0–2 (1·3) ; *lateral pronotal setae* 0–3 (1·1) ; *post-tergital setae* absent, and *antespiracular dorsal setae* 1–3 (2·0). *Antespiracular ventral seta* always one, and *prosternal setae* 1–3 (1·7). *Prothoracic disc pores* on each side : *Medial pronotal pores* 2–5 (3·1) ; *lateral pronotal pores* 1–3 (2·1) ; *antespiracular dorsal pores* 1–2 (1·7). *Prosternal pores* 1–2 (1·1).

Mesothorax : Prescutum 61–89 (76)μ long and 104–143 (131)μ wide (ratio 1 : 1·6–1·8, av. 1·7) ; *prescutal ridge* strong and *prescutal suture* well marked. *Scutum* heavily sclerotized antero-laterally, and with a median longitudinal narrow membranous area ; 85–125 (113)μ long, i.e. the ratio length of prescutum to scutum 1 : 1·3–1·5 (1·46). Pleural structures typical of the family. *Scutellum* pentagonal, 46–64 (58)μ long and 85–116 (104)μ wide, the ratio being 1 : 1·7–1·9 (1·8) ; subequal to half the length of the scutum, ratio 1 : 1·8–2·1 (1·9). *Postalare* with well separated *anterior* and *posterior postalar ridges*. *Postnotal apophysis* large. *Mesopleuron : Mesopleural ridge* interrupted above the coxal articulation ; *basalare* stout. *Subepisternal ridge* well developed. *Mesepisternum* and *mesepimeron* distinct ; *lateropleurite* narrow. *Mesosternum : Basisternum* 122–174 (152)μ long and 146–201 (180)μ wide ; *marginal* and *precoxal ridges* well developed. *Mesothoracic spiracle* 18–21 (19)μ wide at opening, with a 37–43 (40)μ long supporting bar. *Mesothoracic setae* on each side of the median line : *Prescutal setae* 5–9 (6·3) ; *scutal setae* usually 8–11, although 13 setae were found on one side of one specimen (av. 10·0) ; *scutellar setae* 3–6 (3·4). *Tegular setae* 3–5 (4·1). *Postmesostigmatal setae* 4–9 (6·1), in a latero-ventral group. *Basisternal setae* 7–15 (9·9). *Mesothoracic pores : Mesospiracular pores* 0–1 (0·8) ; one *postmesostigmatal pore* almost always present submedially on each side, but none or two pores may occur on one side (av. 1·0).

Metathorax : Metapostnotal sclerites and *metapostnotal ridge* well developed. *Metapleural ridge* attenuated at the point of origin of the *metapleural apophysis*. *Precoxal ridge* well developed and *metasternal apophysis* well defined. *Metathoracic spiracle* similar to mesothoracic. *Metathoracic setae* on each side : *Metatergal setae* 3–5 (4·1) ; *metapleural setae* 0–2 (0·8).

Anterior and *posterior metasternal setae* 2–4 (3·1) and 0–1 (0·6), respectively. *Metathoracic pores : Metatergal pores* absent, and *metaspiracular pores* 0–1 (0·7). *Anterior metasternal pores* 1–2 (1·1), and *posterior metasternal pores* 0–1 (0·9).

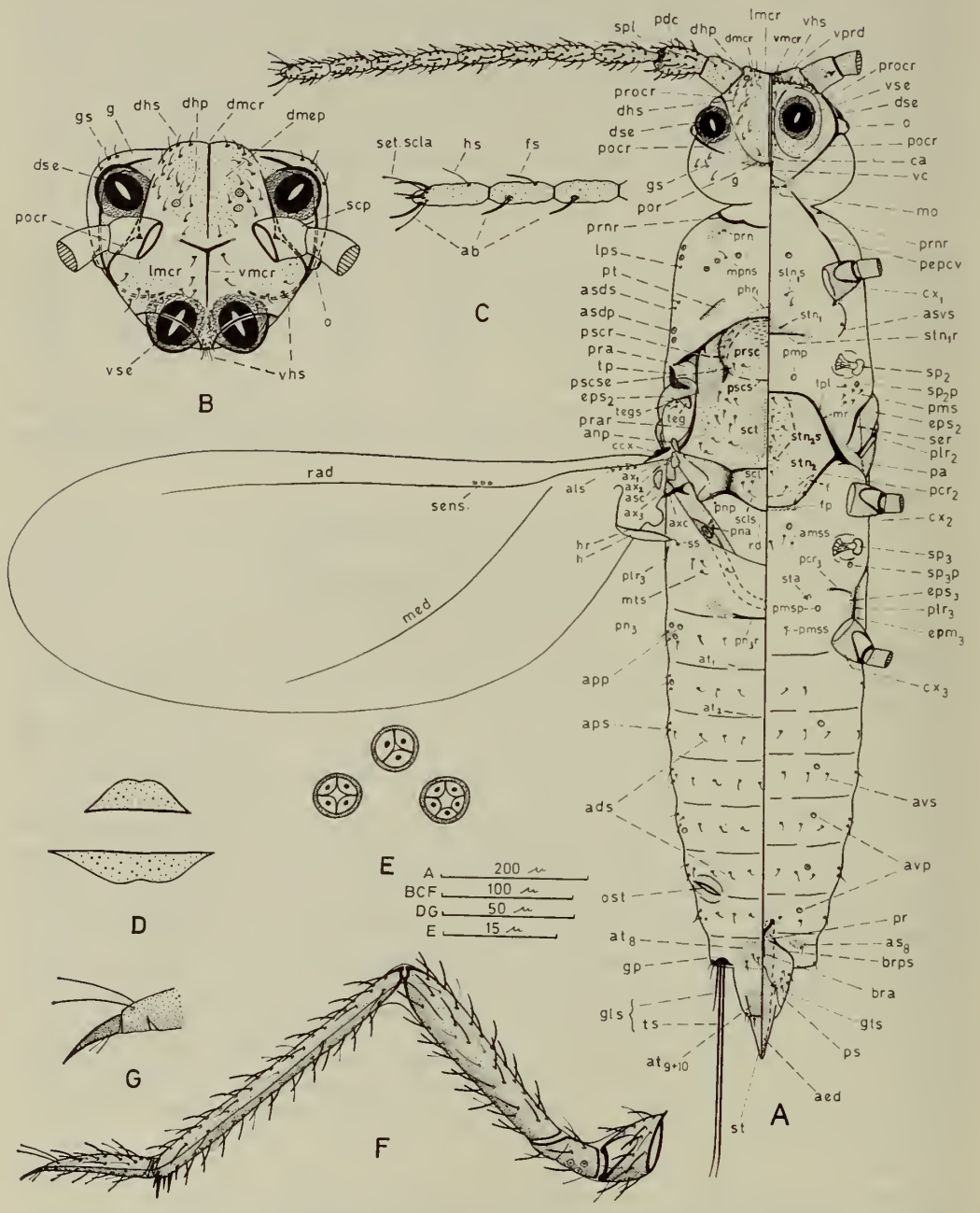


FIG. 15. *Maconellicoccus hirsutus* (Green), dorsal and ventral view.

Wings : 742–1008 (910)μ long and 294–392 (350)μ wide ; with 4–5 (4·2) *alar setae* and a compact row of 3–4 (3·2) minute *circular sensoria*. *Hamulohalterae* 61–79 (73)μ long and 12–15 (14)μ wide ; with a slender ridge and one, 43–55 (49)μ long apically hooked seta, i.e. the ratio length of seta to the length of hamulohaltera 1 : 1·4–1·6 (1·5).

Legs : Moderately long and slender ; the ratio length of the hind leg to the total body length 1 : 1·8–1·9 (1·85). *Coxa* about 49 and *trochanter* about 27μ wide. *Femur* about 37μ wide ; that of the front leg shortest, and that of the hind leg longest ; the ratio width to length of the hind femur 1 : 5·0–5·9 (5·6). *Tibia* about 19μ wide ; with two apical strong spurs and 3–5 smaller spines ; in front leg, the femur always shorter than the tibia, the ratio their lengths being 1 : 1·0–1·1 (1·12). *Tarsus* about 17μ wide ; *tarsal digitules* apically knobbed, 31–37 (34)μ long. *Claw* gradually tapering to a pointed tip ; *ungual digitules* fine. The following table shows the lengths of the leg segments (in microns), and the number of setae on each :

		Fore leg	Middle leg	Hind leg
Coxa	length	37–43 (40)	37–43 (40)	40–49 (46)
	f.s.	8–17 (13·0)	9–16 (12·6)	10–20 (14·8)
	h.s.	5–9 (6·0)	5–8 (6·4)	6–8 (6·8)
Trochanter	length	49–64 (58)	49–64 (58)	55–70 (64)
	f.s.	4–6 (4·6)	4–9 (6·2)	5–8 (6·4)
	h.s.	3–6 (3·8)	3–6)4·0)	3–6 (4·2)
Femur	length	137–198 (177)	143–204 (183)	153–214 (192)
	f.s.	32–44 (38·4)	33–44 (39·0)	38–54 (46·4)
	h.s.	6–9 (7·6)	6–9 (7·7)	7–9 (7·6)
Tibia	length	159–226 (198)	165–241 (211)	214–299 (256)
	f.s.	33–48 (39·4)	38–58 (47·8)	45–69 (54·8)
	h.s.	4–8 (5·4)	5–8 (6·2)	6–9 (6·8)
Tarsus	length	70–89 (82)	70–89 (82)	82–98 (92)
	f.s.	10–17 (13·6)	11–21 (15·0)	13–25 (17·0)
	h.s.	5–8 (6·6)	6–8 (6·8)	6–8 (6·8)
Claw	length	21–27 (24)	21–27 (24)	21–27 (24)
Total length of leg		467–644 (580)	479–665 (598)	564–750 (671)

FIG. 16. *Maconellicoccus hirsutus* (Green), lateral view.

Abdomen : 334–494 (403)μ long and 236–312 (281)μ wide. Tergites of segments I and II small ; those of segments VIII and IX + X large. Sternites of segment VIII weak. *Ostioles* well developed, 37–46 (40)μ long at orifice. *Abdominal setae* on each side : *Dorsal setae* 2–3 on segments I and VIII, and 3–4 on segments II to VII. *Pleural setae* 2–4 on segment I, 4–6 on segments II to VII, and 3–4 on segment VIII, including one slightly longer seta. *Ventral setae* 1–2 on segment II, 2–3 on segments III to VII, and 0–1 on segment VIII. *Abdominal disc pores : Pleural pores* 2–4 (2·8), 0–1 (0·2), 0–1 (0·1), and 0–1 (0·1) on segments I to VI respectively, and absent on segments VII and VIII. One *ventral pore* occurs at least on one side of segments III to VII, forming together a longitudinal sublateral row on each side.

Glandular pouch well developed ; *setae of glandular pouch* include a pair of 229–296 (265)μ long *tail setae* and one, 52–82 (61)μ long seta, i.e the ratio length of the tail setae to the total length of the body 1 : 4·0–4·9 (4·5).

Genital segment moderately large ; subtriangular in dorsal view ; *style* more or less straight and apically rounded in lateral view. *Penial sheath* 140–180 (162)μ long and 67–89 (82)μ wide, the ratio being 1·8–2·4 (2·0) : 1, and the ratio its length to the total body length 1 : 7·1–8·4 (7·6). *Basal ridge of penial sheath* with a small *projection*. *Process of penial sheath* vestigial and hardly indicated. *Aedeagus* comparatively long, anteriorly bent to reach the cavity of abdominal segment VII. *Setae of genital segment :* Dorsally, 3 setae always occur on each side near the base of the style ; ventrally 4–6 (5·1) setae present on each side of the penial sheath, and 3–4 (3·8) *setal sensilla* on its vestigial process.

Material : 10 specimens examined, collected by myself, on *Psidium guava*, in Fayoum, Egypt, U.A.R., during the second week of August, 1964 ; females were identified by A. I. Ezz and confirmed by Y. M. Ezzat.

FERRISIANA Takahashi, 1929

Ferrisiana virgata (Cockerell)

(Text-figs. 17, 18)

Macropterous forms only known ; comparatively long and slender, with moderately long antennae and long legs. When mounted, total body length 1274–1596 (1386)μ, width at mesothorax 294–364 (322)μ, and wing expanse 2296–2576 (2422)μ.

Body setae and *pores :* Antennae and legs with numerous fleshy and very few hair-like setae, about 55μ long ; the body itself with only hair-like setae, about 28μ long. Quadrilocular and occasionally trilocular or quinquelocular disc pores, about 6μ in diameter, occur on the thorax and abdomen.

Head : Irregularly tetrahedron ; subtriangular in dorsal and front views ; *ventral preocular depression* well pronounced in lateral view. Length from apex to postoccipital ridge 113–137 (125)μ ; from apex to neck 174–204 (186)μ ; width across genae 204–253 (220)μ. *Dorsal arm of midcranial ridge* only indicated by a median longitudinal heavy sclerotization. *Lateral* and *ventral* arms forming together a Y-shaped ridge. *Postoccipital ridge* anteriorly confluent with the preocular ridges. *Preocular + interocular ridge* join the *postocular ridge* below the ocellus ; ventral rudiment of the preocular ridge weakly indicated. *Eyes : Dorsal simple eyes* not projecting beyond the outer margins of the head in dorsal view ; their cornea 24–28 (26)μ in diameter and separated by 98–110 (104)μ, i.e. 3·6–4·5 (4·2) times their diameter apart. *Ventral simple eyes* 28–31 (29)μ in diameter and 25–31 (28)μ apart. Lateral *ocelli* well developed. *Cranial apophysis* apically truncate. *Tentorial bridge* slender. *Dorsal head setae* 11–14 (12·5) on each side of the median line ; each gena with 3–4 (3·3) *genal setae*. *Ventral head setae* on each side : 2–4 (3·2) between the ventral eyes ; 5–8 (6·7) forming with their

partners of the other side a band across the area of the preocular depression ; 2–4 (3·3) anteriorly on each side of the ventral arm of the midcranial ridge.

Antennae : Filiform ; normally 10-segmented ; 674–848 (760)μ long, i.e. slightly longer than half the total body length (ratio 1 : 1·7–1·9, av. 1·8), and shorter than the hind legs (ratio 1 : 1·1–1·2, av. 1·14). *Scape* 37–46 (43)μ long and 46–52 (49)μ wide at base ; always with 4 h.s. *Pedical* 64–79 (70)μ long and 34–40 (37)μ wide ; with 12–19 (16·9) f.s., 5–8 (6·0) h.s. and a *sensillum placodeum*. *Flagellum :* Segment III being longest (ratio its length to the length of segment X 1·2–1·6, av. 1·4 : 1) ; the segment about 23μ wide, the ratio its width to its length being 1 : 4·3–5·6 (5·1). Segments IV to X cylindrical and about 21μ wide, the ratio width to length of segment IX being 1 : 2·7–3·1 (2·9). The following table shows the lengths of the flagellar segments and the number of setae on each :

	III	IV	V	VI	VII	VIII	IX	X
length in μ	92–131	64–89	73–95	67–92	67–82	64–76	58–73	73–89
(av.)	(116)	(76)	(79)	(82)	(73)	(70)	(67)	(82)
f.s.	13–19	9–15	13–17	14–19	12–17	12–17	11–15	9–15
(av.)	(15·9)	(12·2)	(14·5)	(17·0)	(14·1)	(14·2)	(12·9)	(12·6)
h.s.	0–2	0–2	0–2	1–2	1–2	0–2	0–1	0–1
(av.)	(0·7)	(0·8)	(0·3)	(1·8)	(1·4)	(1·0)	(0·1)	(0·1)

Antennal bristles conspicuously stout ; segments VIII and IX each with a ventral bristle. Terminal segment with 3 preapical bristles, the dorsal of which slightly shorter and at a greater distance from the apex, two capitate *subapical sensory setae*, and one apical hair-like seta.

Thorax : 555–737 (608).)μ long. *Prothorax : Pronotal ridges* medially interrupted at a weakly sclerotized point. *Lateral pronotal sclerites* and *post-tergites* comparatively large. Dorsal margin of *proepisternum* ridge-like. *Prosternum* triangular, 31–46 (37)μ long ; posteriorly supported by a transverse, 107–128 (113)μ long *prosternal ridge*. *Prothoracic setae* on each side of the median line : *Medial pronotal setae* 2–3 (2·6) ; *lateral pronotal setae* 2–4 (2·9) ; *post-tergital setae* 0–3 (1·4) ; *antespiracular dorsal setae* 2–4 (3·1). One *antespiracular ventral seta* and one *prosternal seta* always present. *Prothoracic pores* on one side : *Medial pronotal pores* 2–6 (3·2) ; *lateral pronotal pores* 1–3 (1·8) ; *antespiracular dorsal pores* 0–1 (0·5). *Prosternal pores* absent.

Mesothorax : Prescutum 92–113 (98)μ long and 128–165 (147)μ wide (ratio 1 : 1·4–1·6, av. 1·5) ; *prescutal ridge* well developed and *prescutal suture* distinct. *Scutum* heavily sclerotized antero-laterally, with a median longitudinal narrow membranous area ; 116–156 (131)μ long, i.e. the ratio lengths of prescutum to scutum 1 : 1·2–1·4 (1·3). *Prealare, prealar ridge, triangular plate, anterior* and *posterior notal wing processes* well developed. *Scutellum* pentagonal, 49–64 (58)μ long and 101–131 (116)μ wide (the ratio being 1 : 1·9–2·2, av. 2·0, and the ratio its length to the length of the scutum 1 : 2·1–2·6, av. 2·3). *Postalare* with well separated *anterior* and *posterior postalar ridges*. *Postnotal apophysis* strong. *Mesopleuron : Mesopleural ridge* interrupted in the usual manner ; basalare stout. *Subepisternal ridge, mesepisternum, latero-pleurite* and *mesepimeron* typical of the family. *Mesosternum : Basisternum* 143–198 (162)μ long and 180–229 (211)μ wide ; bounded by the *marginal* and *precoxal ridges*. *Mesothoracic spiracle* 18–21 (20)μ wide at opening, with a 37–43 (40)μ long supporting bar. *Mesothoracic setae* on each side : *Prescutal setae* 2–4 (3·1) ; *scutal setae* 6–7 (6·3) ; *scutellar setae* 3–4 (3·2). *Tegular setae* 1–3 (1·7). *Postmesostigmatal setae* 2–3 (2·3), occurring only latero-ventrally behind each spiracle. *Basisternal setae* 6–9 (6·8). *Mesothoracic disc pores : Mesospiracular pores* 0–2 (0·8) ; *postmesostigmatal pores* absent.

Metathorax : Metapostnotal sclerites and *metapostnotal ridge* well developed. *Metapleural ridge* attenuated at the point of origin of the *metapleural apophysis ; metapleural wing process* small. *Precoxal ridge* and *metasternal apophysis* well developed. *Metathoracic spiracle* identical with that of the mesothorax. *Metathoracic setae* on each side : *Metatergal setae* 4–5 (4·2). *Dorsostigmatal setae* 0–1 (0·3), and *metapleural seta* always one behind each spiracle.

Anterior and *posterior metasternal setae* 1–2 (1·5) and 2–3 (2·7), respectively. *Metathoracic pores :* 1–2 (1·2) sub-marginal *metatergal pores*, and 2–3 (2·2) *metaspiracular pores* present ; *anterior* and *posterior metasternal pores* absent.

Wings : 1008–1120 (1064)μ long and 420–532 (462)μ wide ; with 3, and occasionally 4

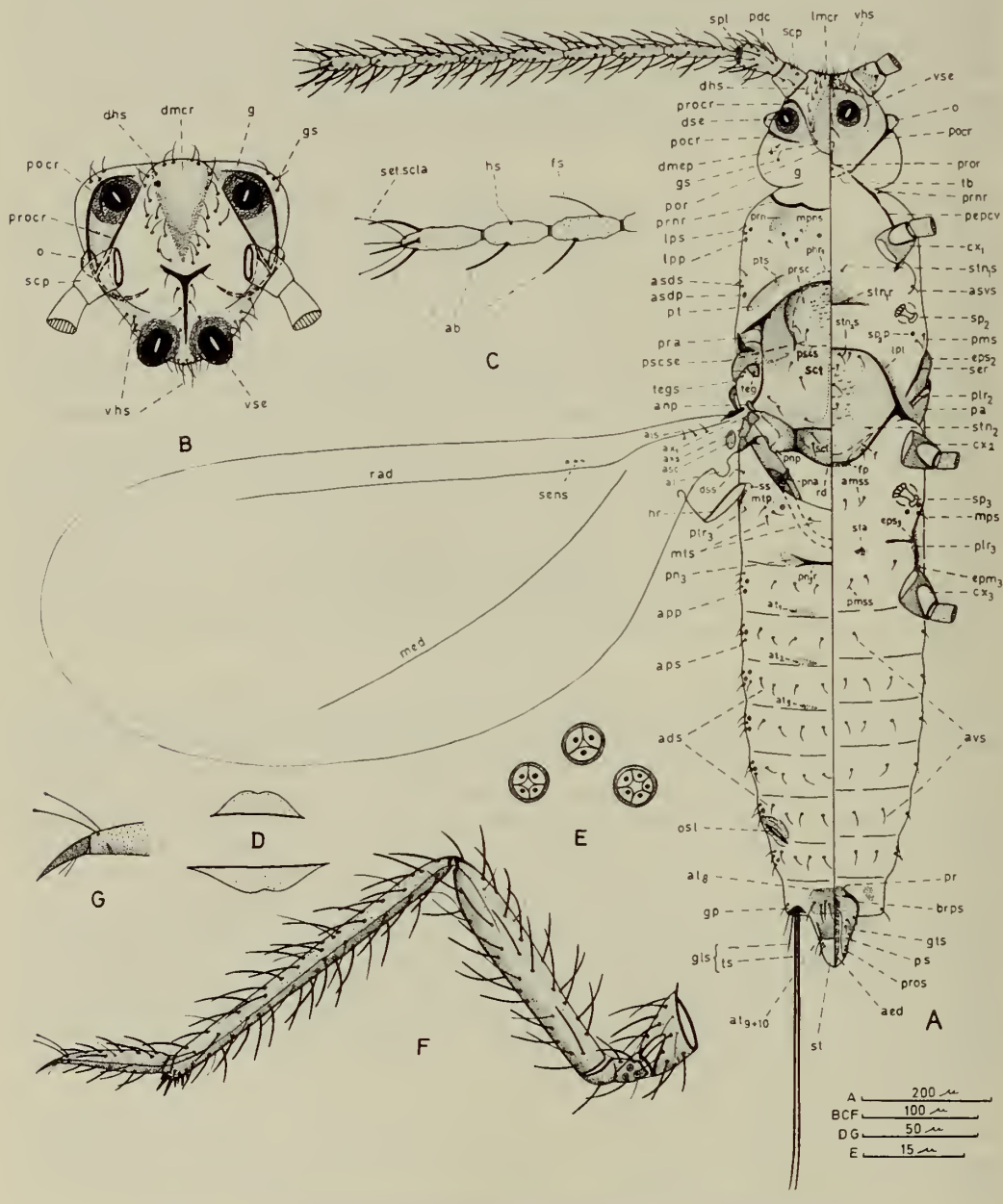


FIG. 17. *Ferrisiana virgata* (Cockerell), dorsal and ventral view.

(av. 3·1) *alar setae*, and a compact row of 3 minute *circular sensoria*. *Hamulohalterae* 76–89 (82)μ long and 15–21 (18)μ wide ; with a 61–70 (64)μ long apically hooked seta, i.e. the ratio length of seta to hamulohaltera being 1 : 1·2–1·5 (1·3).

Legs : Comparatively long and slender ; the ratio length of the hind leg to the total body length 1 : 1·5–1·7 (1·6). *Coxa* and *trochanter* about 51 and 27μ wide respectively. *Femur* about 37μ wide ; that of the fore leg shortest and that of the hind leg longest ; the ratio width to length of hind femur 1 : 6·8–7·6 (7·0). *Tibia* about 21μ wide ; with two apical spurs and 5–8 smaller spines ; in front leg, femur shorter than tibia, the ratio their lengths being 1 : 1·1–1·3 (1·2). *Tarsus* about 21μ wide ; *tarsal digitules* apically knobbed, 34–43 (37)μ long. *Claw* gradually tapering to a pointed tip ; *ungual digitules* fine. The lengths of the leg segments (in microns) and the number of setae on each are given below :

		Fore leg	Middle leg	Hind leg
Coxa	length	43–49 (46)	46–52 (49)	52–58 (55)
	f.s.	13–18 (15·3)	12–18 (14·0)	12–23 (17·5)
	h.s.	2–5 (3·7)	3–5 (4·1)	2–5 (3·6)
Trochanter	length	58–67 (64)	61–67 (64)	65–70 (67)
	f.s.	3–5 (3·6)	3–5 (4·0)	3–5 (4·3)
	h.s.	1–4 (2·7)	1–3 (1·6)	1–3 (1·8)
Femur	length	198–253 (226)	207–259 (232)	232–278 (256)
	f.s.	25–40 (32·6)	27–34 (30·1)	32–41 (35·6)
	h.s.	2–6 (3·6)	2–3 (2·5)	2–5 (3·0)
Tibia	length	220–290 (262)	238–308 (281)	317–397 (357)
	f.s.	30–43 (37·8)	39–48 (43·5)	47–59 (53·0)
	h.s.	1–3 (2·0)	0–3 (1·4)	2–5 (2·9)
Tarsus	length	79–92 (89)	85–95 (91)	98–110 (104)
	f.s.	18–22 (19·6)	20–23 (21·3)	19–24 (22·1)
	h.s.	0–3 (1·7)	0–2 (1·0)	0–2 (0·9)
Claw	length	24–31 (28)	24–31 (28)	24–31 (28)
Total length of leg		622–778 (708)	670–805 (741)	796–946 (872)

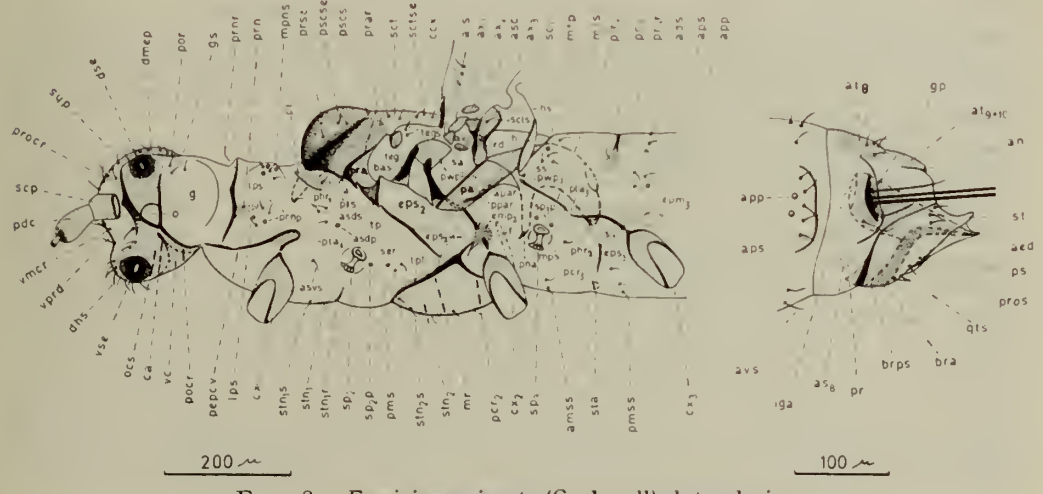


FIG. 18. *Ferrisiana virgata* (Cockerell), lateral view.

Abdomen : 448–593 (509)μ long and 274–327 (304)μ wide. Tergites of segments I, II, III and sometimes IV present ; those of segment VII and segments IX + X large. Sternites of segment VIII weak. *Ostioles* well developed, 37–46 (40)μ long at orifice. *Abdominal setae* on each side : *Dorsal setae* 3–4 on segments I to VIII. *Pleural setae* 2–3 on segments I to VIII, including one slightly longer seta on the latter segment. *Ventral setae* usually 1 and sometimes 2 on segment II, 2–3 on segments III to VII, and absent on segment VIII. *Abdominal disc pores :* Segments I to VII with 1–3 (1·3), 1–2 (1·2), 1–3 (1·8). 1–3 (2·1), 1–3 (1·9), 1, and 1 *pleural pores* respectively.

Setae of glandular pouch include a pair of 409–427 (421)μ long *tail setae* and one, 70–101 (82)μ long seta, i.e. the ratio length of the tail setae to the total length of the body 1 : 3·0–3·6 (3·3).

Genital segment comparatively small ; subtriangular in dorsal view, with a broadly rounded apex ; *style* more or less straight in lateral view. *Penial sheath* 122–137 (128)μ long and 76–92 (79)μ wide ; i.e. the ratio length to width 1·5–1·7 (1·6) : 1, and the ratio its length to the total body length 1 : 10·0–11·6 (10·8). *Basal ridge of penial sheath* and its *projection* well developed ; *process of penial sheath* absent. *Aedeagus* rather stout ; *internal genital aperture* large. *Setae of genital segment :* Dorsally, 3 setae always present on each side near the base of the style ; ventrally, 3–5 (3·8) setae, and 3–4 (3·3) minute *setal sensilla* occur on each side of the penial sheath.

Material : 10 specimens examined, collected by A. I. Ezz, on *Croton* sp., in Cairo, Egypt, U.A.R., 22.xi.1962.

TRIONYMUS Berg, 1899

Trionymus newsteadi (Green)

(Text-figs. 19, 20)

Winged forms only known ; newly emerged males light brown, becoming darker soon afterwards, with dark brown or blackish eyes. They are narrow and slender, comparatively large with short antennae and moderately long legs. When mounted 1190–1498 (1372)μ long, 308–378 (350)μ wide at mesothorax and 2926–3542 (3318)μ wing expanse.

Body setae and *disc pores :* Antennae with numerous fleshy setae, about 31μ long, and a few slightly longer hair-like ones ; legs and main parts of the body with hair-like setae only. Quadrilocular and occasionally quinquelocular disc pores, about 6μ in diameter, occur on the thorax, abdomen and sometimes on the head.

Head : Subtetrahedron ; subtriangular in dorsal and front views ; with a hardly indicated *ventral preocular depression*. Length from apex to postoccipital ridge 116–125 (122)μ ; from apex to neck 183–201 (192)μ ; width across the genae 214–250 (235)μ. *Dorsal arm of mid-cranial ridge* anteriorly separated from other arms and posteriorly meeting the postoccipital ridge. *Lateral* and *ventral arms* forming a Y-shaped ridge. *Postoccipital ridge* anteriorly confluent with preocular ridges. *Preocular + interocular ridges* joining the *postocular ridge* below the ocellus ; preocular ridge with a well defined ventral rudiment. *Preoral ridge* slender. *Eyes : Dorsal simple eyes* not projecting beyond the outer margins of the head in dorsal view ; their corneae 21–27 (24)μ in diameter and separated by 113–134 (125)μ, i.e. 4·6–6·1 (5·1) times their corneae apart. *Ventral simple eyes* 24–34 (30)μ in diameter and 24–31 (27)μ apart. Lateral *ocelli* well developed. *Cranial apophysis* with truncate apex. *Tentorial bridge* slender. *Dorsal head setae* 13–16 (14·7) on each side anterior to the postoccipital ridge ; each gena usually with 4 and occasionally 3 or 5 *genal setae* (av. 3·8). *Ventral head setae* on each side : 1–2 (1·8) between the ventral eyes ; 11–16 (12·4) forming on both sides a transverse band in the

area of the ventral preocular depression ; 3–4 (3·8) on each side of the ventral arm of the medcranial ridge. *Head disc pores : Dorsal pores* usually absent, although one pore was found on one side of a few specimens near the base of the antennae (av. 0·3).

Antennae : Filiform ; 10-segmented ; 610–769 (705)μ long, i.e. subequal to half the total length of the body (ratio 1 : 1·8–2·1, av. 1·9), and subequal to the hind legs (ratio 1 : 0·8–1·1, av. 0·95). *Scape* 46–55 (52)μ long and 46–49 (47)μ wide at base ; always with 4 h.s. *Pedicel* 61–70 (66)μ long and 37–43 (40)μ wide ; with 19–29 (23·1) f.s., 10–14 (12·1) h.s. and a *sensillum placodeum*. *Flagellum :* Segment III club-shaped, about as long as segment X, both being the longest (ratio approximately 1 : 1) ; segment III about 29μ wide, the ratio its width to its length being 1 : 2·5–3·2 (2·9). Segments IV to X cylindrical and 24–27μ wide, the ratio width to length of segment IX being 1 : 2·4–2·9 (2·7). The lengths of the flagellar segments and the number of setae on each are given in the following table :

	III	IV	V	VI	VII	VIII	IX	X
length in μ	70–92	61–76	58–79	58–89	61–89	58–76	58–73	76–92
(av.)	(82)	(67)	(70)	(73)	(73)	(70)	(67)	(82)
f.s.	13–21	16–24	19–30	21–33	21–31	20–26	17–24	16–27
(av.)	(17·0)	(18·8)	(23·9)	(25·9)	(25·7)	(22·6)	(21·0)	(20·1)
h.s.	5–11	2–5	2–5	3–5	2–5	3–6	2–5	1–2
(av.)	(7·4)	(2·6)	(3·9)	(4·3)	(3·7)	(4·2)	(3·1)	(1·7)

Antennal bristles well-defined ; segments VIII and IX each with one ventral bristle. Terminal segment with 3 preapical bristles and two much smaller ones near the base of the segment ; terminal segment also with a pair of capitate *subapical sensory setae* and one apical hair-like seta.

Thorax : 532–707 (722)μ long. *Prothorax : Pronotal ridges* with the usual median interruption. *Lateral pronotal sclerites* and *post-tergites* small. *Proepisternum* with a ridge-like dorsal margin. *Prosternum* 43–58 (52)μ long and comparatively narrow ; posteriorly bounded by the transverse, 92–110 (104)μ long *prosternal ridge*. *Prothoracic setae* on each side : *Medial pronotal setae* 1–2 (1·7) ; *lateral pronotal setae* 1–3 (2·1) ; *post-tergital setae* almost always absent, but one seta was found on each side of one specimen (av. 0·1 h.s.) ; *antespiracular dorsal setae* 2–4 (2·9). One *antespiracular ventral seta* always present. *Prosternal setae* 2–4 (2·5). *Prothoracic pores* on each side : *Medial* and *lateral pronotal pores* 1–3 (averages 2·2 and 2·1 respectively) ; *antespiracular dorsal pores* 1–2 (1·1). *Prosternal pore* usually one, but sometimes two or none at all on either side (av. 1·1).

Mesothorax : Prescutum 92–119 (104)μ long and 131–168 (153)μ wide (ratio 1 : 1·4–1·7, av. 1·5) ; laterally bounded by the *prescutal ridges* and posteriorly by the *prescutal suture*. *Scutum* heavily sclerotized antero-laterally, with a medial longitudinal narrow membranous area ; 110–137 (128)μ long, i.e. the ratio lengths of prescutum to scutum 1 : 1·1–1·3 (1·2). *Prealare, prealar ridge, triangular plate, anterior* and *posterior notal processes* well developed. *Scutellum* 61–73 (70)μ long and 98–125 (116)μ wide, the ratio being 1 : 1·6–1·7 (1·65) and the ratio lengths of scutellum to scutum 1 : 1·7–2·0 (1·8). *Postalare* with well separated *anterior* and *posterior ridges*.

Mesopleuron : Mesopleural ridge with a short interruption above the coxal articulation ; *basalare* stout and *subepisternal ridge* well developed. *Lateropleurita* narrow. *Mesosternum : Basisternum* 162–204 (186)μ long and 168–235 (207)μ wide ; *marginal* and *precoxal ridges* well developed. *Mesothoracic spiracle* about 21μ wide at opening, with a 40–46 (43)μ long supporting bar. *Mesothoracic setae* on each side : *Prescutal setae* 4–7 (5·7) ; *scutal setae* 8–12 (10·1) ; *scutellar setae* 1–2 (1·1). *Tegular setae* 3–5 (4·2). *Postmesostigmatal setae* in two separable groups, a latero-ventral cluster of 8–12 (9·6) setae behind each spiracle, and 1–3 (1·7) setae submedially, forming with their partners of the other side a transverse irregular row. *Basisternal setae* 10–16 (12·7). *Mesothoracic disc pores* on each side : *Mesospiracular pores* 1–2 (1·5) ; one *postmesostigmatal pore* usually present submedially, but sometimes absent on one side (av. 0·8).

Metathorax : Metapostnotal sclerites and *metapostnotal ridge* well developed. *Metapleural ridge* attenuated at the position of the *pleural apophysis ;* with a small *metapleural wing* process. *Metepisternum* and *metepimeron* well defined. *Precoxal ridge* strong and *metasternal apophysis* distinct. *Metathoracic spiracles* similar to the mesothoracic ones. *Metathoracic setae* on each

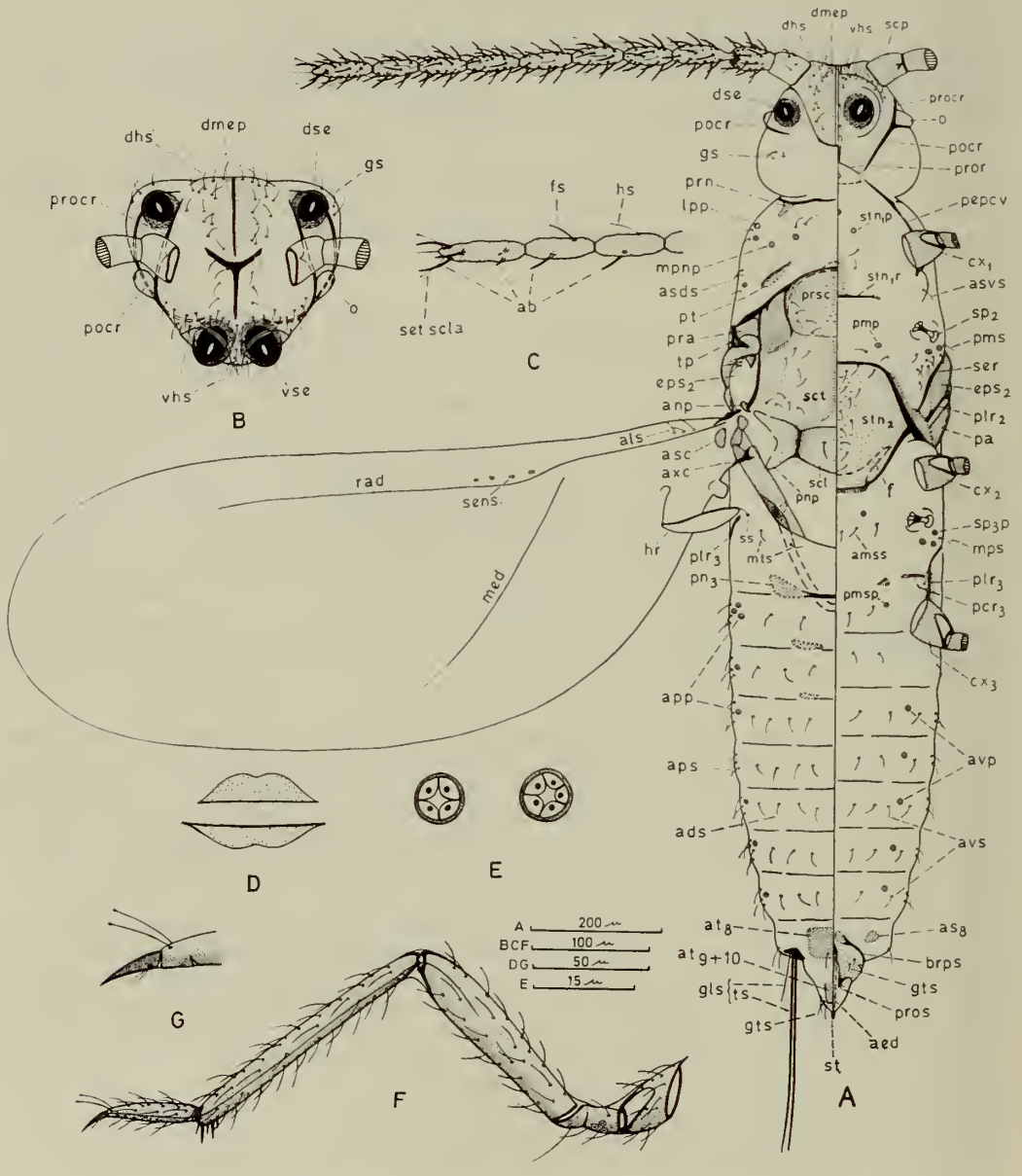


FIG. 19. *Trionymus newsteadi* (Green), dorsal and ventral view.

side : *Metatergal setae* 1–3 (1·7) ; *metapleural setae* 1–2 (1·1) ; *anterior metasternal setae* 3 and *posterior metasternal setae* 2–3 (2·2). *Metathoracic pores : Metaspiracular pores* 2–3 (2·3) behind each spiracle ; one *anterior metasternal pore*, and one *posterior metasternal pore* almost always present on each side (averages 0·8 and 0·9 respectively).

Wings : 1330–1610 (1484)μ long and 462–532 (504)μ wide ; usually with 3 *alar setae* (sometimes 4 or 5, av. 3·4), and a row of 4 minute *circular sensoria*. *Hamulohalterae* 104–122 (110)μ long and 21–31 (25)μ wide ; with one apically hooked, 46–55 (52)μ long seta, i.e. the ratio lengths of the seta to the hamulohaltera 1 : 1·9–2·5 (2·1).

Legs : Moderately long and slender ; the ratio length of the hind leg to the total length of the body 1 : 1·7–2·1 (2·0). *Coxa* and *trochanter* about 49 and 24μ wide respectively ; the latter with one differentiated long *apical seta*. *Femur* about 43μ wide ; that of the front leg shortest and that of the hind longest ; the ratio width to length of the hind femur 1 : 4·1–5·0 (4·6). *Tibia* about 24μ wide ; with 2 apical strong spurs and 3–4 smaller spines ; the ratio lengths of femur to tibia in front leg 1 : 1·0–1·1 (1·05). *Tarsus* about 21μ wide ; *tarsal digitules* apically knobbed, about 37μ long. *Claw* uniformly tapering to a pointed apex ; *ungual digitules* extremely fine. In the following table the lengths of the leg segments (in microns) and the number of setae on each are given :

		Fore leg	Middle leg	Hind leg
Coxa	length	43–49 (46)	43–49 (46)	46–52 (49)
	h.s.	11–14 (12·2)	9–13 (11·4)	10–15 (12·6)
Trochanter	length	58–70 (64)	58–70 (64)	64–73 (70)
	h.s.	4–6 (5·1)	4–6 (5·0)	4–6 (5·2)
Femur	length	153–189 (174)	159–201 (183)	168–220 (198)
	h.s.	17–25 (20·2)	19–26 (22·2)	19–25 (22·8)
Tibia	length	168–198 (183)	174–229 (204)	223–278 (253)
	h.s.	24–35 (28·6)	23–33 (28·2)	25–37 (30·6)
Tarsus	length	76–92 (85)	76–92 (85)	82–104 (95)
	h.s.	15–19 (17·2)	13–20 (16·6)	15–20 (17·4)
Claw	length	27–31 (29)	27–31 (29)	27–31 (29)
Total length of leg		525–619 (580)	537–668 (613)	610–753 (692)

Abdomen : 365–532 (456)μ long and 266–327 (312)μ wide. Tergites of segments I and II small ; those of segment VIII and segments IX + X large and distinct. Sternites of segment VIII ill-defined. *Ostioles* entirely absent. *Abdominal setae* on each side : *Dorsal setae* 2–3 on segment I, 3–4 on segments II to VI, 2–3 on segment VII, and always 1 on segment VIII. *Pleural setae* 3–4 on segment I, 4–5 (and occasionally 6) on segments II to VII, and always 3 on segment VIII. *Ventral setae* 1–2 on segment II, 3–4 on segments III to V, 2–3 on segment VI, 2 on segment VII, and absent on segment VIII. *Abdominal disc pores* on each side : *Pleural setae* 2–5 (3·7), 0–2 (1·1), 0–1 (0·5), 0–1 (0·6), 0–1 (0·7), 0–1 (0·5), and 0–2 (0·7) on segments I to VII respectively. One *ventral pore* also usually occurs submarginally on segments III to VII (averages 0·8, 0·7, 0·7, 0·3, and 0·2 respectively).

Glandular pouch well developed ; its setae include a pair of *tail setae*, 229–305 (272)μ long, and one seta, 40–92 (64)μ long (the ratio lengths of the tail setae to the total body length 1 : 4·6–5·7, av. 5·0).

Genital segment comparatively small ; subtriangular in dorsal view ; *style* curving upwards in lateral view. *Penial sheath* 113–131 (125)μ long and 79–95 (89)μ wide, i.e. the ratio length

to width 1·3–1·4 (1·38) : 1, and the ratio its length to the total body length 1 : 10·2–12·0 (11·0). *Basal ridge of penial sheath* and its projection well developed ; *process of penial sheath* well pronounced. *Aedeagus* gradually pointed. *Setae of genital segment :* Dorsally, 3 setae always present on each side near the base of the style ; ventrally 3–4 (3·7) setae occur on each side of the penial sheath, and 4–5 (4·3) *setal sensilla* on its process.

Material : 10 specimens examined, collected by myself, on beech trees (*Fagus sylvatica*), in the Imperial College Field Station, Silwood Park, Sunninghill, Berkshire, England, iii–iv.1964.

Remarks : Although the present study is mainly concerned with morphology and taxonomy, some biological observations were also made. According to Blaire (1958), the second stage larvae of this species, usually males, migrate from the small twigs towards the main branches and trunk of the trees between February 12th and April 10th ; however, the writer was able to produce adult males from larvae collected during the last two weeks of April. It was found that the second stage larvae take about 48 hours to reach the third stage, and the latter about another 48 hours to become prepupae ; the prepupae take about 7 days to develop to pupae, and the pupae about 8–10 days to produce males with well developed antennae, legs and wings, but still in a stationary condition or with very limited movement. The males became active after about 48 hours, after which the long waxy tassels covering the abdominal segment VIII were produced ; they were then ready to emerge from their puparia and search for the females. The males mated 5–10 times with females introduced to them in the same glass tube ; each copulation usually lasts $1\frac{1}{2}$–3 minutes and may be repeated with the same female or another one at variable intervals from several minutes to a few hours. The males fly in rapid and rather short jumps (a few inches), and all died within 72 hours from their emergence.

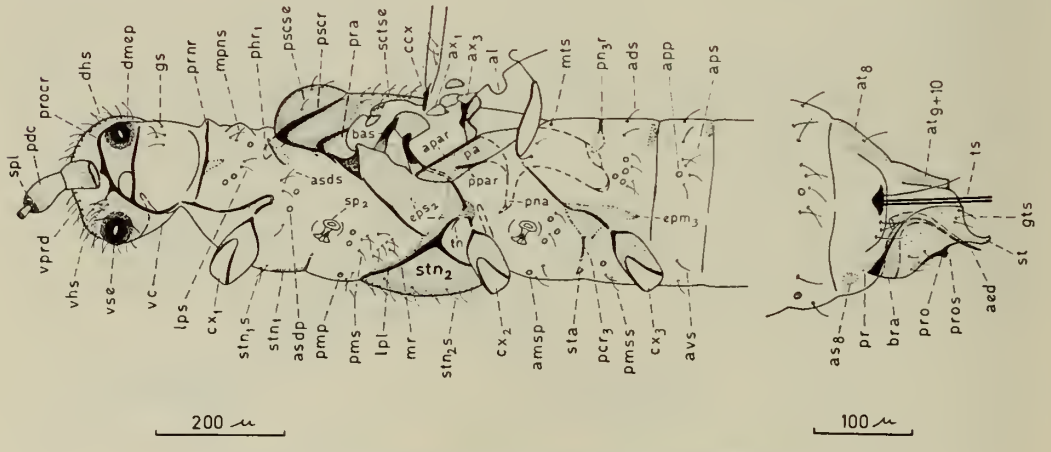


FIG. 20. *Trionymus newsteadi* (Green), lateral view.

PSEUDOCOCCUS Group

PSEUDOCOCCUS Westwood, 1840

Pseudococcus obscurus (Essig)

(Text-figs. 21, 22)

The winged forms only known ; living specimens not available. The males are narrow and slender, of medium or large size and with comparatively short antennae and moderately long legs. When mounted, the total length of the body 1106–1470 (1330)μ, the width at mesothorax 280–350 (322)μ and the wing expanse 1932–2520 (2240)μ.

Body setae and *pores :* Fleshy and hair-like setae present on the body, antennae and legs ; all subequal in length, about 24μ long. Quadrilocular and quinquelocular disc pores about 6μ in diameter, occurring on the head, thorax and abdomen.

Head : Subtetrahedron ; subtriangular in dorsal and front views ; *ventral preocular depression* well pronounced in lateral view. Length from apex to postoccipital ridge 125–153 (137)μ ; from apex to neck 153–192 (180)μ ; width across the genae 180–220 (207)μ. *Dorsal arm of midcranial ridge* anteriorly separated from the other arms by a short distance, and posteriorly meeting the postoccipital ridge. *Ventral* and *lateral arms* forming together a Y-shaped ridge. *Postoccipital ridge* not reaching the preocular ridges anteriorly. *Dorsomedial part of epicranium* well sclerotized. Preocular + interocular ridges join the *postocular ridge* below the ocellus ; ventral rudiment of preocular ridge hardly indicated. *Preoral ridge* slender. *Eyes : Dorsal simple eyes* projecting beyond the outer margins of the head in dorsal view ; their corneae 24–27 (25)μ in diameter and separated by 92–113 (104)μ, i.e. 3·8–4·6 (4·3) times their corneae apart. *Ventral simple eyes* 27–31 (29)μ in diameter and 24–31 (27)μ apart. Lateral *ocelli* large. *Cranial apophysis* apically truncate. *Tentorial bridge* slender. *Dorsal head setae :* 5–8 (6·6) f.s. and 7–11 (9·6) h.s. present on each side of the median line anterior to the postoccipital ridge ; each gena with 13–18 (15·2) fleshy and 3–4 (3·3) hair-like *genal setae. Ventral head setae* on each side : 3–4 (3·3) h.s. between the ventral eyes ; 5–9 (7·1) f.s. and 2–4 (3·2) h.s. forming on both sides a transverse band in the area of the ventral preocular depression ; ventral part of ocular sclerite with 5–11 (8·5) fleshy *ventral ocular setae* ; anteriorly, 3–4 (3·3) h.s. longitudinally arranged on each side of the ventral arm of the midcranial ridge. *Head disc pores : Dorsal head pores* 2–3 (2·2) on each side near the base of the antennae.

Antennae : Filiform ; normally 10-segmented ; 616–668 (647)μ long, i.e. as long as, or somewhat shorter than half the body length, and slightly shorter than the hind legs, the ratios 1 : 2·0–2·2 (2·1) and 1 : 1·1–1·2 (1·12) respectively. *Scape* 43–62 (46)μ long and 43–46 (45)μ wide at base ; with 6–8 (6·7) h.s. *Pedicel* 61–73 (70)μ long and 31–37 (34)μ wide ; with 11–18 (14·7) f.s., 9–16 (12·1) h.s., and a *sensillum placodeum. Flagellum :* Segment III club-shaped, longest of all and about 24μ wide ; the ratio lengths of segments III to X 1·4–1·5 (1·42) : 1, and the ratio width to length of segment III 1 : 3·7–4·6 (4·3). Segments IV to X cylindrical and about 22μ wide ; the ratio width to length of segment X being 1 : 2·4–2·9 (2·6). The following table shows the lengths of the flagellar segments and the number of setae on each :

	III	IV	V	VI	VII	VIII	IX	X
lengths in μ	79–98	61–73	61–73	58–64	55–67	52–67	52–61	61–70
(av.)	(92)	(67)	(67)	(61)	(61)	(58)	(58)	(67)
f.s.	9–14	8–16	12–16	8–16	11–16	10–17	8–14	10–13
(av.)	(11·3)	(12·4)	(14·1)	(11·7)	(13·0)	(12·9)	(11·1)	(10·7)
h.s.	4–7	2–6	2–4	2–5	2–5	3–5	3–8	5–7
(av.)	(5·1)	(3·5)	(3·3)	(2·7)	(3·1)	(3·6)	(5·4)	(6·3)

Antennal bristles : Segments VIII and IX each with one ventral bristle ; segment X with 3 subapical bristles, a pair of capitate *subapical sensory setae*, and one apical hair-like seta.

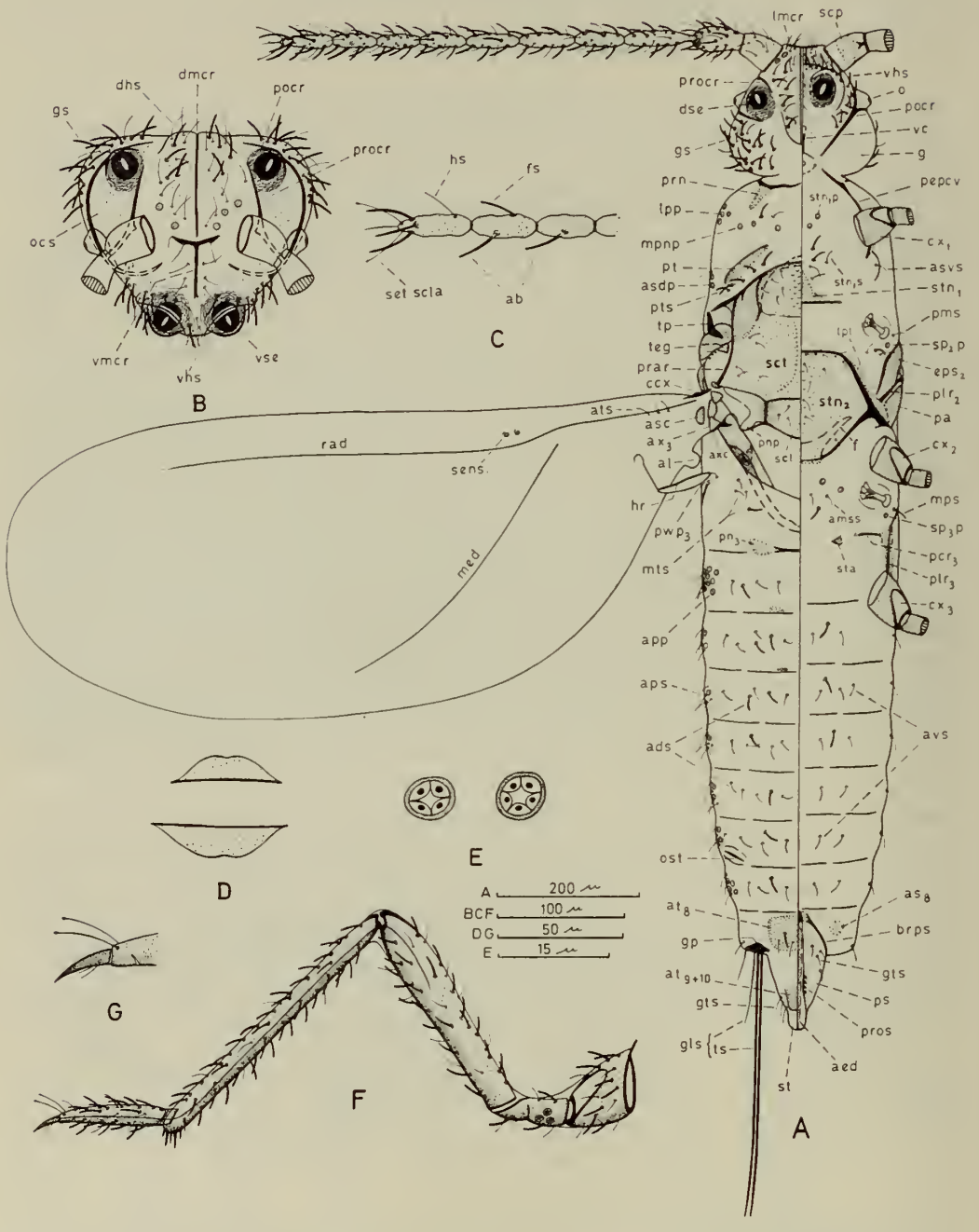


FIG. 21. *Pseudococcus obscurus* (Essig), dorsal and ventral view.

Thorax : 426–570 (524)μ long. *Prothorax : Pronotal ridge* medially interrupted at a weak point. *Lateral pronotal sclerites* and *post-tergites* comparatively large. *Proepisternum* with a ridge-like dorsal margin. *Prosternum* triangular, 37–49 (43)μ long ; *prosternal ridge* 85–116 (101)μ long. *Prothoracic setae* on each side of the median line : *Medial pronotal setae* 0–2 (0·9) f.s. and 0–3 (1·3) h.s. ; *lateral pronotal setae* 0–1 (0·3) h.s. ; *post-tergital setae* 3–6 (4·6) f.s. ; *antespiracular dorsal setae* 0–2 (0·5) h.s. One, hair-like *antespiracular ventral seta* always present. *Prosternal setae* 1–3 (2·1) f.s. and 1–3 (1·8) h.s. *Prothoracic disc pores* on each side : *Medial pronotal pores* 2–4 (2·6) ; *lateral pronotal pores* 2–4 (3·1) ; *antespiracular dorsal pores* 2–4 (2·1). *Prosternal pores* 1–3 (2·1).

Mesothorax : Prescutum 73–92 (79)μ long and 113–146 (131)μ wide, the ratio being 1 : 1·5–1·8 (1·7) ; *prescutal ridge* well developed and *prescutal suture* well defined. *Scutum* heavily sclerotized antero-laterally, with a longitudinal median narrow membranous area. Scutum 101–128 (116)μ long, i.e. the ratio lengths of prescutum to scutum 1 : 1·3–1·6 (1·5). *Scutellum* 46–61 (55)μ long and 89–119 (107)μ wide, the ratio being 1 : 1·8–2·1 (1·9), and the ratio its length to the length of scutum 1 : 2·0–2·2 (2·1). *Anterior* and *posterior postalar ridges* well separated ; *postnotal apophysis* well developed. *Mesopleuron : Mesopleural ridge* interrupted above the articulation with coxa ; *pleural apophysis, pleural wing process, basalare* and *subepisternal ridge* well developed ; *lateropleurite* narrow, *mesepisternum* and *mesepimeron* distinct. *Mesosternum : Basisternum* 128–171 (150)μ long and 168–271 (192)μ wide ; *marginal, precoxal ridges* and *furca* strongly developed. *Mesothoracic spiracle* 21–24 (22)μ wide at opening, with a 34–43 (40)μ long supporting bar. *Mesothoracic setae* on each side : *prescutal setae* 4–6 (4·7) h.s. ; *scutal setae* 4–7 (5·2) h.s. ; *scutellar setae* 2–4 (2·6) h.s. *Tegular setae* 3–5 (3·7) h.s. ; *postmesostigmatal setae* 1–3 (1·6) f.s. and 2–4 (2·6) h.s. occurring only laterally behind each spiracle. *Basisternal setae* 7–12 (9·1) h.s. *Mesothoracic disc pores :* 1–2 (1·6 *mesospiracular pores* posteriorly associated with each spiracle.

Metathorax : Metapostnotal sclerites and *metapostnotal ridge* well developed. *Pleural ridge, pleural wing process, pleural apophysis, episternum* and *epimeron* typical of the family. *Precoxal ridge* and *metasternal apophysis* well developed. *Metathoracic spiracle* identical with the mesothoracic.

Metathoracic setae on each side : *Metatergal setae* 1–2 (1·2) f.s. and 3–4 (3·3) h.s. in a submedian cluster ; *metapleural setae* 1–2 (1·1) f.s. behind the metathoracic spiracles. *Anterior metasternal setae* 1–2 (1·5) f.s. and 1–3 (2·1) h.s. ; *posterior metasternal setae* absent. *Metathoracic disc pores* on each side : *Metaspiracular pores* 0–1 (0·7) ; *anterior metasternal pores* 1–2 (1·6) ; *posterior metasternal pores* absent.

FIG. 22. *Pseudococcus obscurus* (Essig), lateral view.

Wings : 840–1092 (980)μ long and 392–476 (434)μ wide ; with 3 *alar setae* and 2 *circular sensoria*. *Hamulohalterae* 76–85 (79)μ long and 15–21 (18)μ wide ; with one, 55–61 (58)μ long apically hooked seta, i.e. the ratio length of seta to the length of the hamulohaltera about 1 : 1·4.

Legs : Moderately long ; the ratio length of the hind leg to the total length of the body 1 : 1·6–1·8 (1·7). *Coxa* and *trochanter* about 52 and 27μ wide respectively. *Femur* about 43μ wide ; that of fore leg shortest and that of hind leg longest ; the ratio width to length of the hind femur being about 1 : 5·4. *Tibia* about 24μ wide ; with 2 apical stout spurs and 3–5 smaller ones ; the ratio lengths of femur to tibia in fore leg 1 : 1·1–1·2 (1·16). *Tarsus* about 21μ wide ; *tarsal digitules* apically knobbed, about 34μ long. *Claw* uniformly tapering to a pointed tip ; *ungual digitules* finely pointed. In the following table, the lengths of the leg segments (in microns) and the number of setae on each are given :

		Fore leg	Middle leg	Hind leg
Coxa	length	40–46 (43)	40–46 (43)	43–49 (46)
	f.s.	6–11 (9·8)	7–12 (8·5)	9–13 (11·8)
	h.s.	4–9 (6·7)	4–8 (6·2)	6–8 (6·8)
Trochanter	length	67–70 (68)	67–70 (68)	70–73 (71)
	f.s.	1–3 (2·2)	1–4 (2·3)	2–5 (3·0)
	h.s.	3–6 (4·5)	3–6 (4·2)	4–7 (4·8)
Femur	length	189–201 (192)	195–204 (198)	207–220 (211)
	f.s.	23–30 (28·2)	21–29 (26·8)	27–38 (32·2)
	h.s.	9–12 (9·8)	7–11 (8·2)	9–13 (10·0)
Tibia	length	214–235 (223)	232–253 (241)	244–305 (281)
	f.s.	34–48 (42·0)	45–57 (50·8)	58–69 (64·3)
	h.s.	4–7 (5·3)	4–7 (5·2)	4–8 (5·8)
Tarsus	length	85–92 (89)	85–92 (89)	92–104 (98)
	f.s.	17–23 (20·1)	22–27 (24·9)	20–29 (26·2)
	h.s.	3–6 (4·2)	3–6 (4·3)	4–7 (5·3)
Claw	length	24–30 (27)	24–30 (27)	24–30 (27)
Total length of leg		622–659 (634)	644–683 (659)	677–772 (732)

Abdomen : 403–578 (486)μ long and 251–327 (296)μ wide. Tergites of segments I and II small ; those of segments VIII and IX + X large and distinct. Sternites of segment VIII ill-defined. *Ostioles* weakly developed. *Abdominal setae* on each side : *Dorsal setae :* Fleshy setae 0–1 on segment I, 2–3 on segment II, 1–3 on segment III, and 1–2 on segments IV to VIII ; hair-like setae 2–4 on segment I, 3–4 on segments II to V, 2–4 on segments VI and VII, and 1–2 on segment VIII. *Pleural setae* 2–4 h.s. on segment I, 4–5 on segments II to VII, and 3–4 on segment VIII, including one slightly longer seta. *Ventral setae :* Fleshy setae 0–1 on segments II, III and IV ; hair-like setae usually 2–3 on segments II to VII, and occasionally 1 or 4 ; ventral setae absent on segment VIII. *Abdominal disc pores :* Segments I–VII with 6–11 (8·6), 1–2 (1·6), 1–2 (1·5), 1–2 (1·5), 1–3 (1·9), 2–4 (2·5), and 3–5 (4·3) *pleural pores*, respectively.

Glandular pouches well developed ; *setae of glandular pouch* include two, 360–412 (387)μ long *tail setae* and one, 58–92 (76)μ long seta, the ratio length of the tail setae to the total length of the body being 1 : 3·0–3·8 (3·4).

Genital segment : Subtriangular in dorsal view, with the style comparatively broad and apically rounded ; the latter curving upwards in lateral view. *Penial sheath* 153–168 (162)μ long and 76–89 (85)μ wide, i.e. the ratio its length to its width 1·8–2·0 (1·9) : 1, and its length to the total length of the body 1 : 7·2–8·9 (8·2). *Basal ridge of penial sheath* with a small *projection ; process of penial sheath* absent. *Aedeagus* tapering to a pointed tip. *Setae of*

genital segment : Dorsally, 3 small setae always present on each side near the base of the style ; *ventrally* 4–5 (4·4) similar setae, and 4–5 (4·3) minute *setal sensilla* occur on each side of the penial sheath.

Material : 10 specimens examined, obtained by K. Boratynski in a laboratory culture on Potato, in London during vi.1961.

Remarks : Wilkey and McKenzie (1961) attempted to reveal the long puzzling identity of *P. maritimus* and whether more than one species of mealybug is involved under the so-called *P. maritimus-malacearum* complex. They carried out a morphological investigation on the females primarily based on the shape of the hind legs and the number of the translucent dots on the leg segments ; this investigation led to the conclusion that *P. maritimus* and *P. obscurus* are distinct species, *P. bakeri* Essig and *P. omniverae* Hollinger being synonyms of the former, and *P. capensis* Brain, *P. longispinus* var. *latipes* Green and *P. malacearum* Ferris of the latter. Accordingly, Beardsley (1963) realized that the species long believed to be *P. maritimus* in Hawaii, whose males were described as such by him in an earlier paper (1960), was in fact *obscurus*.

Beardsley's description of this species indicates that it is identical with *P. obscurus* here studied, and both entirely agree with "*P. maritimus* Ehrhorn, type B" described by Giliomee (1961) ; therefore, "*P. maritimus*, type A" at present is uncertain and may perhaps be the true *P. maritimus*.

Pseudococcus citriculus Green

(Text-figs. 23, 24)

Winged forms only known ; living specimens not available. The males are comparatively slender, of medium or large size, with short antennae and moderately long legs. When mounted, total body length 1232–1400 (1302)μ, width at mesothorax 280–322 (294)μ and wing expanse 2016–2338 (2128)μ.

Body setae and *pores :* The body antennae and legs with fleshy and hair-like setae, about 27μ long. Quadrilocular and quinquelocular disc pores present on the head, thorax and abdomen, 6–9μ in diameter.

Head : Subtetrahedron ; triangular in dorsal and front views ; *ventral preocular depression* well pronounced in lateral view. Length from apex to postoccipital ridge 122–140 (128)μ ; from apex to neck 171–214 (186)μ ; width across the genae 201–229 (214)μ. *Dorsal arm of midcranial ridge* anteriorly detached from other arms, and posteriorly meeting or almost meeting the postoccipital ridge. *Ventral* and *lateral arms* forming together a Y-shaped ridge. *Postoccipital ridge* not reaching the preocular ridges anteriorly. *Preocular + interocular ridges* well developed ; ventral rudiment of the former hardly indicated by a weak sclerotization. *Preoral ridge* slender. *Eyes : Dorsal simple eyes* not projecting beyond the outer margins of the head in dorsal view ; their corneae 21–24 (23)μ in diameter, and separated by 92–119 (104)μ, i.e. 3·8–5·0 (4·3) times their corneae apart. *Ventral simple eyes* 24–27 (26)μ in diameter, and 18–37 (27)μ apart. *Lateral ocelli* well developed. *Cranial apophysis* with truncate apex ; *tentorial bridge* slender. *Dorsal head setae :* 8–11 (9·3) f.s. and 9–12 (10·5) h.s. on each side anterior to the postoccipital ridge ; each gena with 16–23 (19·0) fleshy and 2–4 (3·0) hair-like *genal setae. Ventral head setae* on each side : 2–3 (1·3) h.s. between the ventral eyes ; 7–10 (8·8) f.s. and 2–5 (3·3) h.s. forming on both sides a transverse band in the area of the ventral preocular depression ; ventral part of ocular sclerites with 4–7 (3·8) fleshy *ventral ocular setae ;*

anteriorly, 0–1 (0·2) f.s. and 3–4 (3·5) h.s. on each side of the ventral arm of the midcranial ridge. *Head disc pores :* 1–3 (1·6) *dorsal head pores* occur on each side near the base of the antennae.

Antennae : Filiform ; normally 10-segmented ; 540–604 (570)μ long, i.e. slightly shorter than half the body length, the ratio being 1 : 2·2–2·3 (2·28), and shorter than the hind legs,

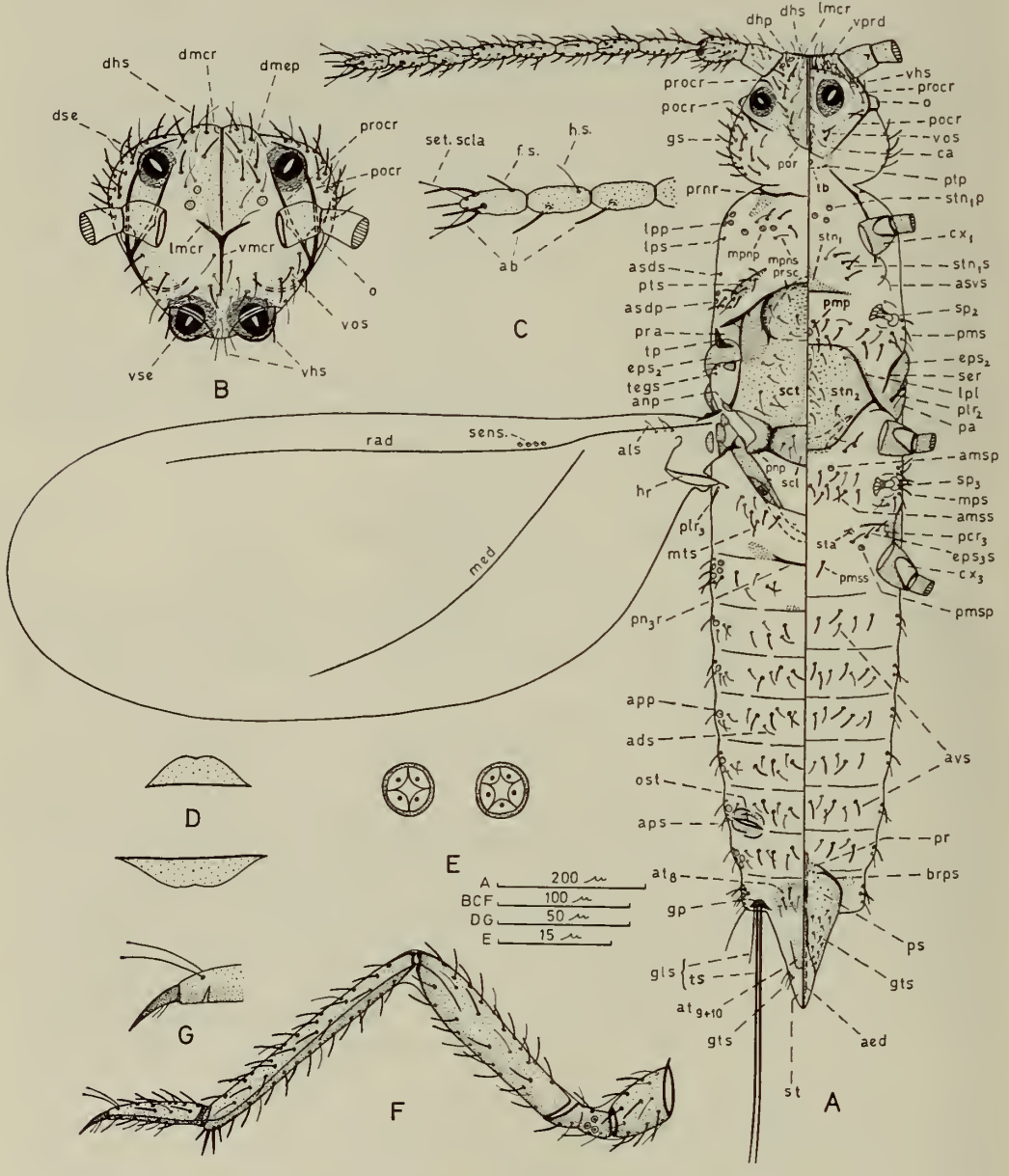


FIG. 23. *Pseudococcus citriculus* Green, dorsal and ventral view.

the ratio 1 : 1·1–1·3 (1·13). *Scape* 46–52 (49)μ long and 40–43 (42)μ wide at base ; with 6–9 (7·3) h.s. *Pedicel* 58–64 (61)μ long and 34–37 (35)μ wide ; with 17–22 (20·0) f.s., 10–14 (12·0) h.s. and a *sensillum placodeum*. *Flagellum :* Segment III club-shaped, longest of all and about 24μ wide ; the ratio lengths of third and terminal segments being 1·3–1·6 (1·4) : 1, and the ratio width to length of segment III 1 : 3·3–4·3 (3·7). Segments IV–X cylindrical and approximately 22μ wide ; the ratio width to length of segment IX 1 : 2·0–2·3 (2·1). The following table shows the lengths of the flagellar segments and the number of setae on each :

	III	IV	V	VI	VII	VIII	IX	X
length in μ	70–92	52–55	52–58	52–58	52–58	49–58	49–55	55–58
(av.)	(79)	(54)	(55)	(56)	(56)	(54)	(53)	(57)
f.s.	11–14	15–19	12–16	12–15	10–16	6–12	8–10	6–8
(av.)	(12·3)	(17·0)	(14·0)	(13·5)	(12·5)	(10·3)	(8·8)	(7·0)
h.s.	4–7	3–4	2–4	3–4	5–7	6–7	7–9	7–8
(av.)	(5·3)	(3·3)	(3·0)	(3·5)	(5·5)	(6·8)	(8·0)	(7·3)

Antennal bristles easily distinguishable ; segments VIII and IX each with a ventral bristle. Terminal segment with 3 preapical bristles, a pair of capitate *subapical sensory setae* and one apical hair-like seta.

Thorax : 494–608 (547)μ long. *Prothorax : Pronotal ridge* medially interrupted as usual. *Lateral pronotal sclerites* and *post-tergites* large. Dorsal margin of *proepisternum* ridge-like. *Prosternum* triangular, 31–40 (34)μ long ; posteriorly bounded by the transverse, 92–101 (98)μ long *prosternal ridge*. *Prothoracic setae* on each side : *Medial pronotal setae* 2–4 (3·3) f.s. and 1–3 (2·7) h.s. ; *lateral pronotal setae* 0–1 (0·9) h.s. ; *post-tergital setae* 10–13 (11·5) f.s. and 1–2 (1·7) h.s. ; *antespiracular dorsal setae* 0–2 (1·3) h.s. *Antespiracular ventral setae* 1–2 (1·3) h.s. *Prosternal setae* 3–5 (4·3) f.s. and 1–2 (1·3) h.s. *Prothoracic disc pores* on each side : *Medial pronotal pores* 2–4 (2·5) ; *lateral pronotal pores* 4–5 (4·3) ; *antespiracular dorsal pores* 1–3 (2·0). *Prosternal pores* 2–4 (3·3).

Mesothorax : Prescutum 67–82 (73)μ long and 122–137 (128)μ wide, i.e. the ratio 1 : 1·6–1·9 (1·7) ; *prescutal ridge* strong and *prescutal suture* distinct. *Scutum* heavily sclerotized antero-laterally, and with a longitudinal median narrow membranous area. Scutum 110–128 (119)μ long, the ratio lengths of prescutum to scutum being 1 : 1·5–1·8 (1·6). *Prealare, prealar ridge* and *triangular plate* well developed. *Scutellum* 52–58 (55)μ long and 101–116 (107)μ wide, the ratio being 1 : 1·9–2·0 (1·94), and the ratio its length to the length of scutum 1 : 2·–1

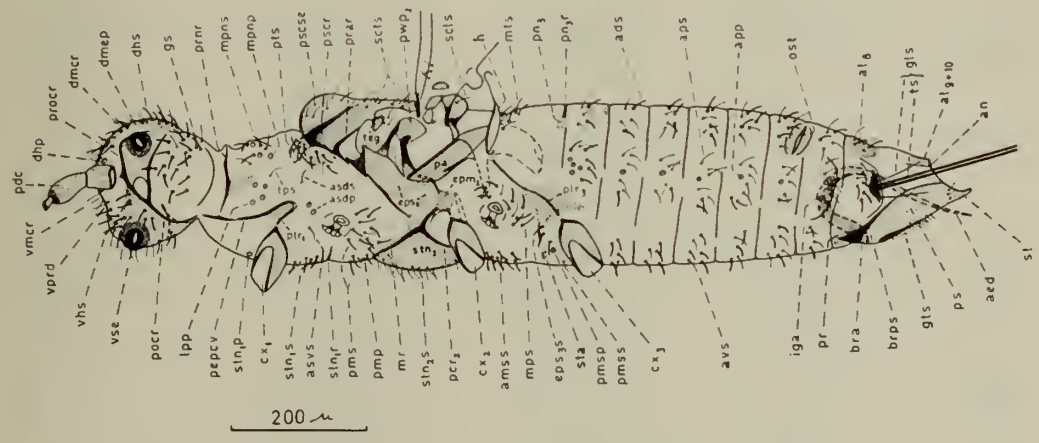


FIG. 24. *Pseudococcus citriculus* Green, lateral view.

2·2 (2·17). *Anterior* and *posterior postalar ridges* well separated. *Mesopleuron : Mesopleural ridge* interrupted above the coxal articulation ; *mesopleural apophysis* and *pleural wing process* well developed ; *basalare* strong. *Subepisternal ridge, mesepisternum, mesepimeron* and *laterotergite* typical of the family. *Mesosternum : Basisternum* 131–156 (143)μ long and 168–198 (177)μ wide ; *marginal* and *precoxal ridges* well developed. *Mesothoracic spiracle* 18–21 (20)μ wide at opening, with a 34–40 (37)μ long supporting bar. *Mesothoracic setae* on each side : *Prescutal setae* 5–7 (6·0) h.s. ; *scutal setae* usually in two groups, the anterior including 3–5 (3·3) h.s. and the posterior with 4–5 (4·3) slightly longer setae ; *scutellar setae* 2–3 (2·7) h.s. *Tegular setae* 3–4 (3·3) h.s. ; *postmesostigmatal setae* 13–19 (16·8) f.s. and 1–4 (2·8) h.s. forming on both sides a transverse band. *Basisternal setae* 10–13 (11·5) h.s. *Mesothoracic disc pores : Mesospiracular pores* 0–1 (0·5) behind each spiracle ; one *postmesostigmatal pore* always present medially.

Metathorax : Metapostnotal sclerites and *metapostnotal ridge* well developed ; *pleural ridge, pleural wing process, mesepisternum* and *mesepimeron* well developed. *Precoxal ridge* and *metasternal apophysis* strong. *Metathoracic spiracle* identical with the mesothoracic. *Metathoracic setae* on each side : *Metatergal setae* 2–5 (3·8) f.s. and 3–4 (3·7) h.s. ; *metapleural setae* 8–10 (8·8) f.s. and 0–2 (0·5) h.s. ; *postmetastigmatal setae* 3–4 (3·5) f.s. *Anterior metasternal setae* 7–12 (9·3) f.s. and 2–3 (2·6) h.s. ; *posterior metasternal setae* 0–1 (0·8) f.s. and 0–1 (0·5) h.s. *Metathoracic disc pores : Metaspiracular pores* absent ; *anterior* and *posterior metasternal pores* 0–1 (0·8) and 0–1 (0·5) on each side, respectively.

Wings : 882–1022 (938)μ long and width 350–420 (378)μ wide ; with 3–4 (3·2) *alar setae* and a compact row of 3–4 (3·2) minute *circular sensoria*. *Hamulohalterae* 67–82 (76)μ long and 15–18 (17)μ wide ; with one, 43–49 (46) apically hooked seta, i.e. the ratio lengths of the seta to the hamulohaltera 1 : 1·4–1·8 (1·7).

Legs : Moderately long ; the ratio length of the hind leg to the total length of the body 1 : 2·0–2·1 (2·02). *Coxa* and *trochanter* about 48 and 24μ wide respectively. *Femur* about 40μ wide ; that of the fore leg usually shortest but sometimes equal to that of the middle leg ; the ratio width to length of the hind femur about 1 : 4·7. *Tibia* about 24μ wide ; with 2 apical stout spurs and 4–6 smaller spines ; the ratio lengths of femur to tibia of the fore leg 1 : 1–1·1 (1·03). *Tarsus* about 21μ wide ; with a pair of apically knobbed *tarsal digitules*. *Claw* gradually tapering to a pointed end ; with a pair of finely pointed *ungual digitules*. The lengths of the leg segments (in microns) and the number of setae on each are given in the following table :

		Fore leg	Middle leg	Hind leg
Coxa	length	40–46 (43)	40–46 (43)	43–49 (46)
	f.s.	8–16 (12·0)	9–15 (11·3)	10–17 (13·0)
	h.s.	6–10 (7·8)	7–10 (8·3)	7–9 (8·3)
Trochanter	length	58–61 (59)	58–61 (59)	61–67 (64)
	f.s.	4–5 (4·3)	4–5 (4·3)	4–5 (4·8)
	h.s.	4–6 (5·0)	4–7 (5·3)	4–6 (4·8)
Femur	length	168–183 (174)	171–186 (177)	177–195 (186)
	f.s.	29–34 (31·0)	28–35 (32·0)	36–48 (40·0)
	h.s.	8–13 (10·0)	8–12 (9·3)	7–14 (9·8)
Tibia	length	183–192 (189)	195–207 (201)	229–244 (238)
	f.s.	33–43 (39·0)	38–46 (41·8)	48–60 (53·0)
	h.s.	6–8 (7·0)	6–10 (8·3)	8–10 (9·0)
Tarsus	length	73–79 (76)	73–79 (76)	76–82 (79)
	f.s.	10–16 (14·0)	10–16 (13·3)	12–18 (15·0)
	h.s.	8–12 (9·8)	8–13 (10·5)	8–14 (11·3)
Claw	length	24–30 (27)	24–30 (27)	24–30 (27)
Total length of leg		558–577 (567)	567–595 (583)	628–656 (644)

Abdomen : 403–433 (418)μ long and 266–304 (281)μ wide. Tergite of segment I small ; those of segments VIII and IX + X large. Sternites of segment VIII ill-defined. *Ostioles* large and prominent, 43–49 (45)μ long at orifice. *Abdominal setae* on each side : *Dorsal setae :* Fleshy setae 2–3 on segments I to III, 3–4 on segments IV to VI, and 2–4 on segments VII and VIII ; hair-like setae 2–3 on segment I, 3–4 on segments II to V, 2–3 on segments VI and VII, and 2–4 on segment VIII. *Pleural setae :* Fleshy setae 2–5 on segment I, usually 1–2 on segments II to VII (sometimes 3 on segments II and V), and 4–6 on segment VIII ; hair-like setae 1–3 on segment I, 4 on segment II, usually 5 on segments III to VII (sometimes 6 on segment VI), and 3–5 on segment VIII, including one conspicuously longer seta. *Ventral setae :* Fleshy setae on segments II and III, 3–5 on segment IV, 3–4 on segment V, 2–3 on segments VI and VII, and absent on segment VIII. *Abdominal pores :* Segments I to VII with 3–6 (4·3), 1–2 (1·3), 1–2 (1·3), 1–2 (1·5), 1–2 (1·5), 1–3 (1·8), and 3–4 (3·8) *pleural pores* respectively.

Glandular pouch well developed ; *seta of glandular pouch* comprise a pair of 336–366 (354)μ long *tail setae* and one 64–79 (73)μ long seta ; the ratio length of the tail setae to the total length of the body 1 : 3·4–4·0 (3·7).

Genital segment : Comparatively large ; triangular in dorso-ventral view. *Style* more or less straight in lateral view ; apically rounded. *Penial sheath* 183–214 (198)μ long and 104–107 (105)μ wide, i.e. the ratio length to width 1·7–2·1 (1·9) : 1, and the ratio its length to the total length of the body 1 : 6·3–6·9 (6·6). *Basal ridge of penial sheath* and its *projection* well developed ; *process of penial sheath* absent. *Aedeagus* comparatively long and slender, anteriorly reaching the cavity of abdominal segment VII and tapering to a sharply pointed tip. *Setae of genital segment* on each side : *Dorsally*, 3 small setae always present near the base of the style ; *ventrally*, 10–15 (12·3) much finer setae scattered on the penial sheath.

Material : 4 specimens only were available, collected by C. R. Wallace, on *Citrus*, in Sarawak, xi.1963 (received from Dr. D. J. Williams).

DYSMICOCCUS Ferris, 1950

Dysmicoccus alazon Williams

(Text-figs. 25, 26)

Only the winged forms known. These are greenish brown with dark red eyes. A relatively long and slender species, with short antennae and moderately long legs. Mounted specimens 1274—1470 (1358)μ long, 280–322 (294)μ wide at mesothorax and 2632–3094 (2800)μ wing expanse.

Body setae and *pores :* Body and appendages with numerous fleshy and hair-like setae, about 24μ long. Quadrilocular and quinquelocular disc pores occur on the head, thorax and abdomen, 6–9μ in diameter.

Head : Subtetrahedron ; subtriangular in dorsal and front views ; *ventral preocular depression* well pronounced in lateral view. Length from apex to postoccipital ridge 116–134 (125)μ ; from apex to neck 168–198 (180)μ ; width across the genae 198–229 (214)μ. *Dorsal arm of midcranial ridge* anteriorly separated from other arms, and posteriorly fading out before reaching the postoccipital ridge. *Ventral* and *lateral arms* forming a Y-shaped ridge. *Postoccipital ridge* anteriorly confluent with preocular ridges. *Dorsomedial part of epicranium* slightly raised. *Preocular + interocular ridges* join the *postocular ridge* below the ocellus ; ventral rudiment of the *preocular rige* indicated by a weak sclerotization. *Preoral ridge* slender. *Eyes : Dorsal simple eyes* projecting beyond the outer margins of the head in dorsal view ; their corneae 21–27 (24)μ in diameter and separated by 101–116 (110)μ, i.e. 3·9–5·3 (4·5) times their diameter apart. *Ventral eyes* 24–31 (27)μ in diameter, and 21–34 (28)μ apart. *Lateral*

ocelli large. *Ocular sclerites* well sclerotized. *Cranial apophysis* with truncate apex. *Tentorial bridge* slender. *Dorsal head setae* on each side : 5–10 (7·3) f.s. and 6–12 (9·4) h.s. anterior to postoccipital ridge ; *dorsal ocular setae* 0–2 (1·1) f.s. ; *genal setae* 7–15 (10·9) f.s. and 3–7 (4·0)

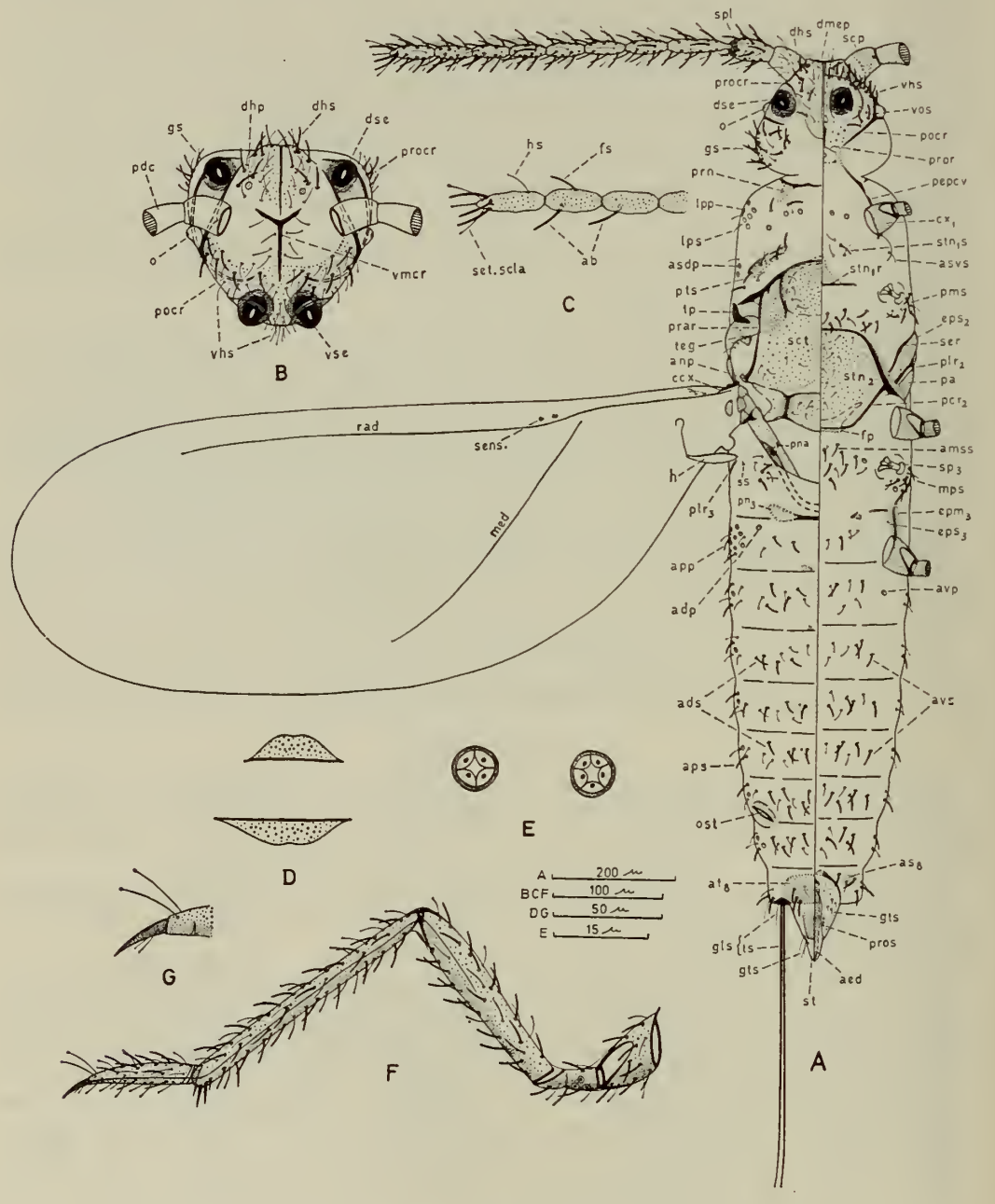


FIG. 25. *Dysmicoccus alazon* Williams, dorsal and ventral view.

h.s. *Ventral head setae* on each side : 3–5 (4·1) h.s. between the ventral eyes ; 10–16 (42·2) f.s. and 1–3 (2·3) h.s. forming with their partners of the other side a transverse band in the area of the ventral preocular depression ; *ventral ocular setae* 3–6 (4·4) f.s. and 0–2 (0·9) h.s. ; a row of 0–1 (0·1) f.s. and 2–4 (2·8) h.s. present on each side of the ventral arm of the midcranial ridge. *Head disc pores :* 1–2 (1·1) *dorsal head pores* occur near the base of each antenna ; *ventral pores* absent.

Antennae : Filiform ; normally 10-segmented ; 586–699 (647)μ long, i.e. about as long as half the body length (ratio 1 : 2·0–2·2, av. 2·1), and shorter than the hind legs (ratio 1 : 1·1–1·3, av. 1·2). *Scape* 46–50 (48)μ long and 43–46 (44)μ wide at base ; with 5–8 (5·9) h.s. *Pedicel* 61–70 (67)μ long and 34–37 (35)μ wide ; with 14–20 (17·3) f.s., 10–17 (13·3) h.s. and a *sensillum placodeum. Flagellum :* Segment III club-shaped and longest of all, the ratio lengths of third to terminal segments being 1·3–1·5 (1·4 : 1 ; segment III about 24μ wide, the ratio its width to its length 1 : 3·5–5·0 (4·6). Segments IV to X cylindrical and about 22μ wide, the ratio width to length of segment IX being 1 : 2·5–2·9 (2·7). The lengths of the flagellar segments and the number of setae on each are given in the following table :

	III	IV	V	VI	VII	VIII	IX	X
length in μ	85–107	55–76	58–70	52–67	52–64	52–64	55–64	64–76
(av.)	(98)	(67)	(64)	(61)	(58)	(58)	(58)	(70)
f.s.	10–17	12–19	13–16	11–16	11–14	13–16	9–13	8–12
(av.)	(13·5)	(14·8)	(14·0)	(13·8)	(12·7)	(14·5)	(11·2)	(10·1)
h.s.	2–6	1–4	1–4	2–6	2–6	2–5	2–6	2–6
(av.)	(4·3)	(3·0)	(3·2)	(4·3)	(3·7)	(3·7)	(4·0)	(3·2)

Antennal bristles easily distinguishable ; segments VIII and IX each with a ventral bristle. Terminal segment with 3 preapical bristles, a pair of capitate *subapical sensory setae* and one apical hair-like seta.

Thorax : 532–616 (570)μ long. *Prothorax : Pronotal ridge* medially interrupted by a weak sclerotization. *Lateral pronotal sclerites* and *post-tergites* distinct. *Proepisternum* with a ridge-like dorsal margin. *Prosternum* triangular, 31–40 (37)μ long ; *prosternal ridge* 85–95 (92)μ long. *Prothoracic setae* on each side : *Medial pronotal setae* 1–5 (1·9) f.s. and 1–3 (1·6) h.s. ; *lateral pronotal setae* 1–2 (1·3) h.s. ; *post-tergital setae* 3–9 (5·9) f.s. and 1–2 (h.s. ; *antespiracular dorsal setae* 1–2 (1·2) h.s. One, hair-like *antespiracular ventral seta* always present. *Prosternal setae* 1–4 (1·8) f.s. and 1–3 (1·6) h.s. *Prothoracic disc pores* on each side : *Medial pronotal pores* 2–4 (2·7) ; *lateral pronotal pores* 4–6 (5·1) ; *antespiracular dorsal pores* 1–3 (1·9). *Prosternal pores* 1–3 (2·0).

Mesothorax : Prescutum 79–98 (85)μ long and 116–143 (131)μ wide, the ratio being 1 : 1·4–1·6 (1·5) ; laterally bounded by the *prescutal ridge* and posteriorly by the *prescutal suture.*

Fig. 26. *Dysmicoccus alazon* Williams, lateral view.

Scutum heavily sclerotized antero-laterally, with a median longitudinal narrow membranous area ; scutum 107–128 (116)μ long, i.e. the ratio lengths of prescutum to scutum 1 : 1·3–1·5 (1·4). *Prealare, prealar ridge* and *triangular plate* well developed. *Scutellum* 52–70 (61)μ long and 92–110 (101)μ wide (ratio 1 : 1·6–1·7, av. 1·65, and the ratio its length to the length of scutum 1 : 1·8–2·1, av. 1·9). *Anterior* and *posterior postalar ridges* separated. *Mesopleuron : Mesopleural ridge* interrupted above the coxal articulation ; *mesopleural apophysis, mesopleural wing process, subepisternal ridge* well developed ; *basalare* stout. *Mesepisternum* and *mesepimeron* distinct ; *lateropleurite* narrow. *Mesosternum : Basisternum* 143–186 (156)μ long and 177–192 (186)μ wide ; bounded by the *marginal* and the *precoxal ridges*. *Mesothoracic spiracle* 18–21 (20)μ wide at opening, with a 37–46 (40)μ long supporting bar. *Mesothoracic setae* on each side : *Prescutal setae* 3–5 (4·1) h.s. ; *scutal setae* 4–6 (4·8) h.s. ; *scutellar setae* 4–7 (5·1) h.s. *Tegular setae* 1–2 (1·4) h.s. *Postmesostigmatal setae* in two groups, 3–7 (4·6) f.s. and 1–4 (2·1) h.s. behind each spiracle, and 3–9 (6·1) f.s. and 1–3 (1·9) h.s. separated medially. *Basisternal setae* 9–16 (11·9) h.s. *Mesothoracic disc pores : Mesospiracular pores* 0–1 (0·2).

Metathorax : Metapostnotal sclerites, metapostnotal ridge and metapleural structures typical of the family. *Metathoracic spiracles* identical with the mesothoracic. *Metathoracic setae* on each side : *Metatergal setae* 1–5 (2·7) f.s. and 2–6 (4·7) h.s. ; *metapleural setae* 2–8 (4·8) f.s. and 1–3 (1·4) h.s. *Anterior metasternal setae* 3–7 (5·3) f.s. and 2–6 (3·4) h.s. ; *posterior metasternal setae* (pmss) 0–2 (1·3) f.s. and 1–4 (1·8) h.s. *Metathoracic disc pores : Metaspiracular pores* 0–2 (0·9) ; *anterior metasternal pores* 0–1 (0·4).

Wings : 1190–1400 (1274)μ long and 406–532 (448)μ wide ; with 1–4 (2·2) *alar setae* and 2 minute *circular sensoria*. *Hamulohalterae* 73–82 (76)μ long and 15–18 (16)μ wide ; with a 49–61 (55)μ long apically hooked seta, i e. the ratio length of seta to the length of hamulohaltera 1 : 1·3–1·5 (1·4).

Legs : Moderately long and slender ; the ratio length of the hind leg to the total length of the body 1 : 1·7–2·0 (1·8). *Coxa* and *trochanter* about 52 and 24μ wide respectively. *Femur* about 37μ wide ; that of fore leg shortest and that of hind leg longest ; the ratio width to length of the hind femur 1 : 5·8–6·4 (6·1). *Tibia* about 22μ wide, with 2 apical spurs and 3–5 smaller spines ; the ratio lengths of femur to tibia of fore leg 1 : 1·0–1·2 (1·1). *Tarsus* about 21μ wide ; with a pair of apically knobbed *tarsal digitules*. *Claw* uniformly tapering to a pointed end ; with a pair of fine *ungual digitules*. The following table shows the lengths of leg segments (in microns) and the number of setae on each :

		Fore leg	Middle leg	Hind leg
Coxa	length	40–46 (44)	40–46 (44)	43–49 (45)
	f.s.	9–12 (10·4)	9–13 (11·1)	10–14 (11·2)
	h.s.	7–10 (8·8)	8–14 (10·2)	10–15 (12·4)
Trochanter	length	61–64 (63)	61–64 (63)	64–70 (68)
	f.s.	1–5 (2·8)	2–5 (3·2)	3–5 (3·9)
	h.s.	2–4 (3·1)	2–4 (3·6)	2–5 (4·1)
Femur	length	186–211 (198)	189–217 (204)	214–235 (226)
	f.s.	13–19 (15·6)	19–26 (21·7)	22–31 (25·4)
	h.s.	14–21 (17·3)	13–25 (20·6)	18–31 (26·1)
Tibia	length	198–238 (214)	229–259 (241)	284–320 (299)
	f.s.	20–31 (24·0)	23–36 (29·4)	32–43 (37·7)
	h.s.	22–35 (26·2)	22–39 (32·2)	28–49 (40·3)
Tarsus	length	85–92 (88)	89–95 (92)	98–107 (104)
	f.s.	8–12 (10·4)	8–12 (10·6)	9–14 (11·7)
	h.s.	12–17 (14·7)	14–19 (15·5)	14–20 (17·4)
Claw	length	27–34 (30)	27–34 (30)	27–34 (30)
Total length of leg		616–680 (637)	662–711 (683)	741–808 (769)

Abdomen : 464–585 (502)μ long and 274–304 (289)μ wide. Tergites of segments I and II small ; those of segments VIII and IX + X large and well sclerotized. Sternites of segment VIII ill-defined. *Ostioles* well developed, 40–46 (43)μ long at orifice. *Abdominal setae* on each side : *Dorsal setae :* Fleshy setae 1–3 on segment I, usually 2–5 on segments II to VII (sometimes 1 on segment II and 6 on segments V and VII), and 1–3 on segment VIII ; hair-like setae 0–2 on segment I, 2–4 on segments II to VII, and 0–3 on segment VIII. *Pleural setae :* Fleshy setae 0–4 on segments I to VIII ; hair-like setae 2–4 on segment I, 3–5 on segments II to VII, and 2–5 on segment VIII, including one slightly longer seta. *Ventral setae :* Fleshy setae 1–2 on segment II, and usually 2–4 on segments III to VIII (sometimes 5 or 6 on segments VI and VII, and only 1 on segment VIII) ; hair-like setae usually 2–4 on segments II to VII (sometimes 3 or 5 on segment III), and 0–1 on segment VIII. *Abdominal pores :* Segments I to VII with 6–10 (7·5), 0–2 (0·3), 0–2 (0·5), 0·2 (0·5), 0–1 (0·8), 1–3 (1·5), and 2–4 (2·8) *pleural pores*. One *dorsal pore* may also occur on segments I and II, and one *ventral pore* on segments II and III.

Setae of glandular pouch consist of a pair of 397–488 (424)μ long *tail setae* and one seta about 40μ long, i.e. the ratio length of the tail setae to the total length of the body 1 : 2·7–3·7 (3·2).

Genital segment comparatively small ; subtriangular in dorsal view ; *style* slightly curving upwards in lateral view. *Penial sheath* 140–153 (150)μ long and 82–95 (89)μ wide, i.e. the ratio length to width 1·5–1·9 (1·7) : 1, and the ratio its length to the total length of the body 1 : 8·7–10·3 (9·1). *Basal ridge of penial sheath* and its *projection* well developed ; *process of penial sheath* absent. *Aedeagus* relatively wide at its *basal rod*, becoming narrower towards its pointed apex. *Setae of genital segment* on each side : 3 setae always occur dorsally near the base of the style ; 3–4 (3·8) smaller setae and 3–4 (3·2) *setal sensilla* present ventrally on the penial sheath.

Material : 8 specimens examined, collected by myself, 20.iv.1964, on a bunch of bananas bought in a London fruit shop, imported from the Canary Islands ; the females were identified by K. Boratynski and confirmed by Dr. D. J. Williams.

SACCHARICOCCUS Group

SACCHARICOCCUS Ferris, 1950

Saccharicoccus sacchari (Cockerell)

(Text-figs. 27–30)

Both macropterous and apterous forms of this species were available.

(A) *The macropterous form* (Text-figs. 27 and 28).

Living specimens light brown. A narrow and slender species, comparatively large, with short antennae and short legs. When mounted, total length of body 1260–1400 (1316)μ, width at mesothorax 252–280 (226)μ and wing expanse 1764–2072 (1932)μ.

Body setae and *pores :* Antennae and legs with numerous fleshy, 21–27μ long setae, and a few hair-like, slightly longer ones. The body itself with fine hair-like setae only. Quadrilocular and occasionally quinquelocular disc pores always present on head, thorax and abdomen, about 6μ in diameter.

Head : Subtetrahedron ; subtriangular in dorsal view ; dorso-ventrally flattened in front and lateral views ; *ventral preocular depression* entirely absent. Length from apex to post-occipital ridge 122–137 (131)μ ; from apex to neck 159–180 (171)μ ; width across the genae 180–198 (192)μ. *Dorsal arm of midcranial ridge* marked only by slender sclerotization, some-

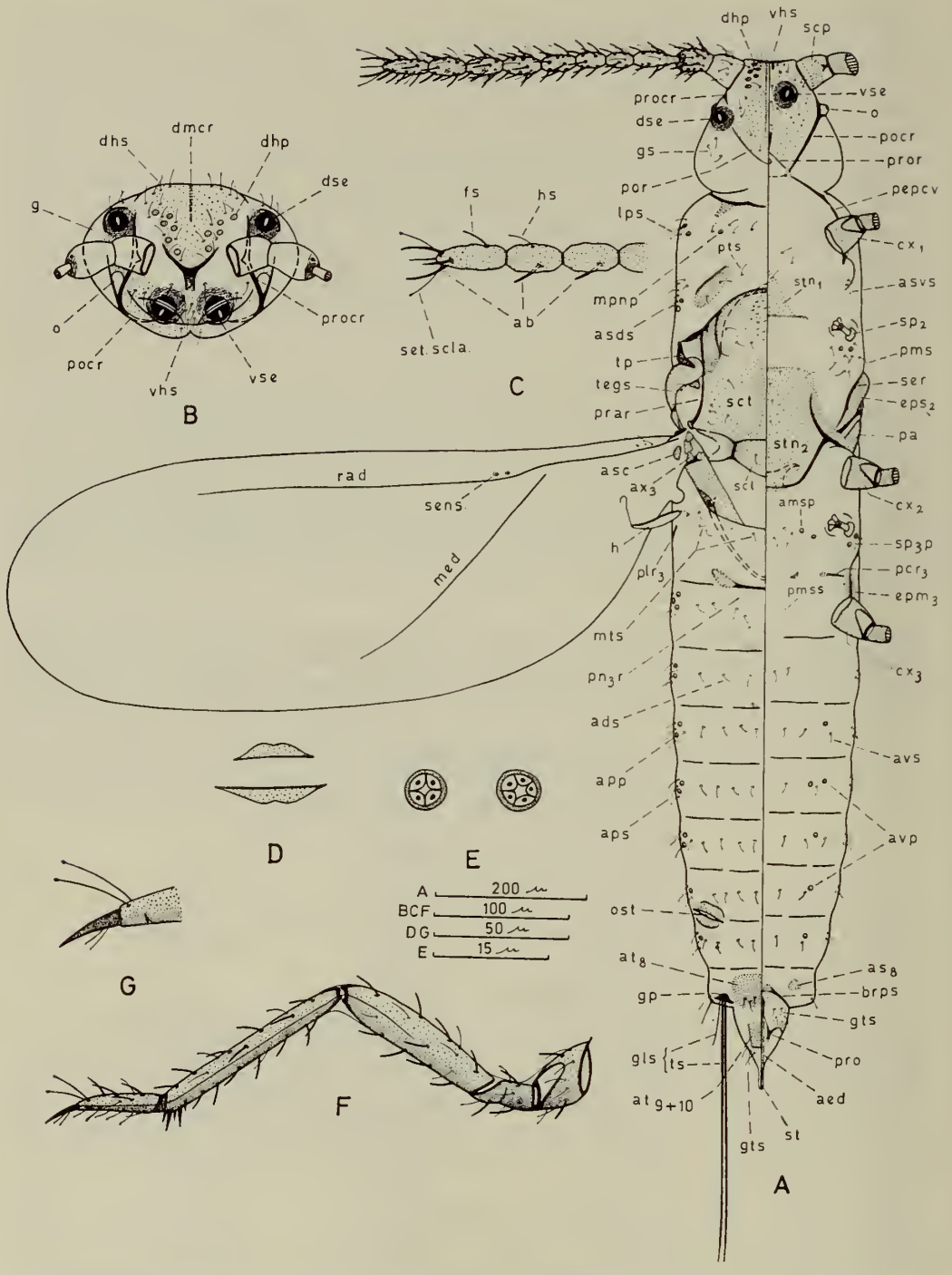


FIG. 27. *Saccharicoccus sacchari* (Cockerell), macropterous form, dorsal and ventral view.

times short or reaching the level of the dorsal eyes. *Lateral arms* forming together with the *ventral arm* a Y-shaped ridge. *Postoccipital ridge* V-shaped and medially interrupted at a weak point ; the ridge not reaching the preocular ridges anteriorly. *Dorsomedial part of epicranium* slightly raised. *Preocular* and *interocular ridges* well developed ; ventral rudiment of the former absent. The dorsal part of the *postocular ridge* reduced to an atrophied arm. *Preoral ridge* slender. *Eyes : Dorsal simple eyes* not projecting beyond the outer margins of the head in dorsal view ; their corneae 15–21 (18)μ in diameter and separated by 104–116 (110)μ, i.e. 5·0–7·6 (6·0) times their diameter apart. *Ventral simple eyes* 18–21 (20)μ in diameter and 21–31 (24)μ apart. Lateral *ocelli* well developed. *Cranial apophysis* apically truncate. *Tentorial bridge* slender. *Dorsal head setae* 10–14 (11·6) on each side in front of the postoccipital ridge ; each gena always with 3 *genal setae*. *Ventral head setae* on each side : 2–3 (2·4) between the ventral eyes ; 8–11 (9·3) just anterior to the ventral eyes, forming on both sides a transverse band. *Head pores :* 4–7 (5·1) *dorsal head pores* present near the base of each antenna ; *ventral pores* absent.

Antennae : Filiform ; normally 10-segmented but fusion between two adjacent segments of the flagellum seems to be common ; 412–482 (455)μ long, i.e. shorter than half the length of the body, the ratio being 1 : 2·7–3·1 (2·9), and shorter than the hind leg, the ratio 1 : 1·1–1·3 (1·2). *Scape* 34–37 (36)μ long and 40–43 (41)μ wide at base ; with 5–7 (6·2) h.s. *Pedicel* 46–49 (48)μ long and 31–34 (33)μ wide ; with 8–16 (12·2) f.s., 6–10 (8·4) h.s. and a *sensillum placodeum*. *Flagellar segments :* Segment III club-shaped, subequal in length to segment X, the ratio their lengths being 0·8–1·1 (0·9) : 1. The flagellar segments about 21μ wide, i.e. the ratio width to length of segments III and IX 1 : 2·3–2·9 (2·6) and 1 : 1·9–2·3 (2·1), respectively. The following table shows the lengths of the flagellar segments and the number of setae on each :

	III	IV	V	VI	VII	VIII	IX	X
length in μ	49–61	31–40	34–40	37–46	43–49	43–55	43–49	55–61
(av.)	(55)	(36)	(38)	(43)	(47)	(49)	(48)	(58)
f.s.	5–9	5–10	5–10	6–13	9–17	8–16	8–13	10–15
(av.)	(7·2)	(7·4)	(7·6)	(10·4)	(13·4)	(13·2)	(11·6)	(12·6)
h.s.	1–3	1–2	1–2	2–3	3–5	2–5	2–4	4–6
(av.)	(1·8)	(1·6)	(1·2)	(2·2)	(4·0)	(3·8)	(3·4)	(4·8)

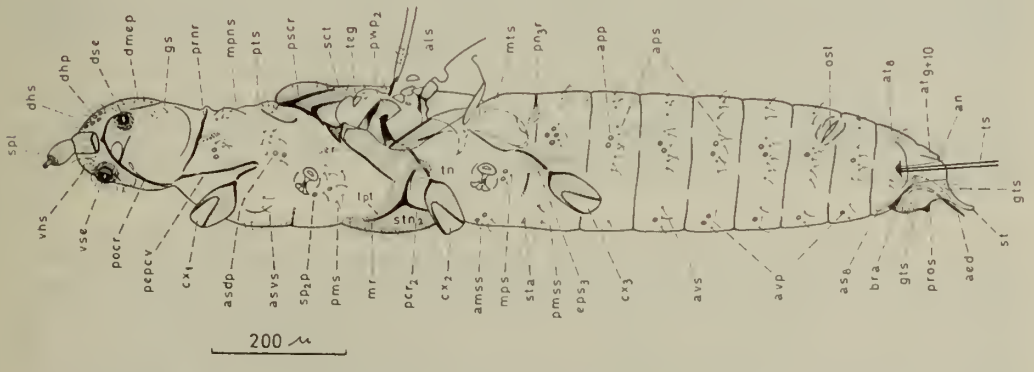


FIG. 28. *Saccharicoccus sacchari* (Cockerell), macropterous form, lateral view.

Antennal bristles distinct ; segments VIII and IX each with one ventral bristle. Terminal segment with 3 preapical bristles, 2 capitate *subapical sensory setae* and 1 apical hair-like seta.

Thorax : 517–570 (540)μ long. *Prothorax : Pronotal ridges* medially interrupted as usual. *Lateral pronotal sclerites* small, and *post-tergites* comparatively large. *Proepisternum* with a ridge-like dorsal margin. *Prosternum* subtriangular, 49–58 (52)μ long and 89–98 (92)μ wide ; *prosternal ridge* absent, and its position only indicated by a narrow sclerotization. *Prothoracic setae* on each side : *Medial pronotal setae* 3–5 (3·9) ; *lateral pronotal setae* 3–5 (3·4) ; *post-tergital setae* 2–4 (3·0) ; *antespiracular dorsal setae* usually 5–7, and occasionally 9 (average 6·1). *Antespiracular ventral setae* usually 2, and occasionally 3 (av. 2·1) ; *prosternal setae* 2–4 (2·9). *Prothoracic disc pores* on each side : *Medial pronotal pores* 0–1 (0·3) ; *lateral pronotal pores* 2–4 (2·6) ; *post-tergital pores* absent ; *antespiracular dorsal pores* 2–3 (2·1). One *prosternal pore* may occur on either side (av. 0·4).

Mesothorax : Prescutum 85–95 (92)μ long (it is difficult to determine the actual length of the scutum due to the absence of the prescutal suture), and 125–140 (134)μ wide, the ratio length to width being 1 : 1·4–1·6 (1·5) ; *prescutal ridge* well developed and *prescutal suture* absent. *Scutum* heavily sclerotized anterolaterally, with a median membranous longitudinal narrow area ; 92–116 (110)μ long, i.e. the ratio lengths of prescutum to scutum 1 : 1·1–1·3 (1·2). *Prealare, prealar ridge, triangular plate, anterior* and *posterior notal wing processes* well developed. *Scutellum* 46–52 (49)μ long and 92–104 (95)μ wide, i.e. the ratio its length to its width 1 : 1·9–2·1 (1·94), and the ratio its length to the length of scutum 1 : 2·0–2·4 (2·3). *Postalare* with well separated *anterior* and *posterior ridges*. *Postnotal apophysis* comparatively small. *Mesopleuron : Mesopleural ridge* interrupted above the coxal articulation ; *basalare* stout. *Subepisternal ridge* slender. *Mesepisternum* and *mesepimeron* distinct ; *lateropleurite* moderately large. *Mesosternum : Basisternum* 134–159 (153)μ long and 137–159 (146)μ wide ; the antero-median part of the *marginal ridge* absent ; *precoxal ridge* well developed. *Furca* comparatively small. *Mesothoracic spiracle* 18–21 (20)μ wide at opening, with a 34–40 (37)μ long supporting bar. *Mesothoracic setae* on each side : *Prescutal setae* 3–5 (3·6) ; *scutal setae* 5–7 (5·3) ; *scutellar setae* 1–3 (2·1). *Tegular setae* 2–4 (2·6). *Postmesostigmatal setae* 6–10 (7·7) in a latero-ventral group. *Basisternal setae* 5–7 (6·1). *Mesothoracic pores :* 1–2 (1·4) *mesospiracular pores* present behind each spiracle ; *postmesostigmatal pores* absent.

Metathorax : Metapostnotal sclerites and *metapostnotal ridge* well developed. *Metapleural ridge* with usual attenuation near the middle at the point of origin of the *metapleural apophysis*. *Precoxal ridge* slender and *metasternal apophyses* small. *Metathoracic spiracle* identical with the mesothoracic one. *Metathoracic setae* on one side : *Metatergal setae* 4–7 (5·1) ; *metapleural setae* 1–3 (2·4). *Anterior metasternal setae* 3–6 (4·3) and *posterior metasternal setae* 2–3 (2·2). *Metathoracic pores* on each side : *Metaspiracular pores* 1–3 (1·9) ; *anterior metasternal pores* usually 1–2 and occasionally 3 or 4 (av. 1·9) ; *posterior metasternal pores* absent.

Wings : 770–910 (854)μ long and 280–350 (322)μ wide ; with 2–4 (3·1) *alar setae* and 2 minute *circular sensoria*. *Hamulohalterae* 64–70 (69)μ long and 12–15 (14)μ wide ; with one apically hooked, 40–46 (43)μ long seta, i.e. the ratio lengths of seta to hamulohaltera 1 : 1·4–1·7 (1·6).

Legs : Short and slender ; the ratio length of hind leg to the total body length 1 : 2·3–2·4 (2·38). *Coxa* and *trochanter* about 49 and 24μ wide respectively. *Femur* about 40μ wide ; that of the hind leg longest and those of the front and middle legs of about the same length ; the ratio width to length of the hind femur 1 : 3·8–4·2 (4·1). *Tibia* about 19μ wide ; with two apical strong spurs and 2–4 smaller spines ; the ratio lengths of femur to tibia in front leg 1–1·1 (1·06) : 1. *Tarsus* about 18μ wide ; *tarsal digitules* apically knobbed. *Claw* uniformly tapering to a sharply pointed tip ; *ungual digitules* extremely fine. The lengths of the leg segments (in microns) and the number of setae on each are given below :

		Fore leg	Middle leg	Hind leg
	length	40–43 (42)	40–43 (42)	43–46 (44)
Coxa	f.s.	1–2 (1·6)	1–3 (1·8)	1–2 (1·6)
	h.s.	5–7 (6·2)	5–8 (7·2)	6–8 (6·4)
	length	52–58 (55)	52–58 (55)	55–61 (58)
Trochanter	f.s.	1–2 (1·4)	1–2 (1·4)	1–3 (2·2)
	h.s.	3–6 (4·6)	3–5 (4·2)	4–5 (4·4)
	length	143–159 (153)	143–159 (153)	153–168 (162)
Femur	f.s.	10–17 (12·4)	10–16 (11·6)	9–14 (12·0)
	h.s.	6–9 (7·4)	5–9 (7·2)	6–8 (7·4)
	length	134–159 (143)	146–171 (159)	177–192 (186)
Tibia	f.s.	14–17 (15·4)	12–18 (15·2)	12–19 (15·6)
	h.s.	4–7 (5·8)	4–9 (6·2)	5–8 (6·4)
	length	67–70 (68)	67–70 (68)	73–76 (74)
Tarsus	f.s.	3–6 (4·6)	2–4 (3·2)	3–2 (4·4)
	h.s.	7–9 (8·2)	6–9 (7·4)	7–9 (7·8)
Claw	length	24–30 (27)	24–30 (27)	24–30 (27)
Total length of leg		464–512 (485)	476–525 (500)	528–573 (552)

Abdomen : 448–562 (502)μ long and 243–274 (258)μ wide. Tergites of segments I and II small ; those of segments VIII and IX + X large and distinct. Sternites of segment VIII weakly sclerotized. *Ostioles* well developed, 40–46 (43)μ long at orifice. *Abdominal setae* on each side : *Dorsal setae* 3–5 on segments I to VI, and 2–4 on segments VII and VIII. *Pleural setae* 4–6 on segment I, 5–7 on segments II to VII, and 3–4 on segment VIII, including a slightly longer seta. *Ventral setae* usually 2–3 on segments II to VII (sometimes 4 on segments III and IV), and absent on segment VIII. *Abdominal pores :* Segments I to VII with 3–5 (3·9), 1–3 (1·4), 1–3 (1·7), 1–3 (1·7), 1–3 (1·7), 1–2 (1·3), and 1 *pleural pore*, respectively. Segments II to VII also with 0–1 (0·1), 0–2 (1·1), 0–2 (1·1), 0–2 (1·0), 0–1 (0·7), and 0–2 (0·9) *ventral pores*, respectively.

Glandular pouch small ; *setae of glandular pouch* include a pair of 305–336 (320)μ long *tail setae* and one seta, 40–55 (46)μ long, i.e. the ratio length of the tail setae to the total length of the body 1 : 4·0–4·2 (4·1).

Genital segment subtriangular in dorsal view. *Style* apically rounded, rather straight in lateral view. *Penial sheath* 131–150 (137)μ long and 70–79 (73)μ wide, the ratio being 1·8–1·9 (1·87) : 1, and the ratio its length to the total body length 1 : 9·3–10·1 (9·6). *Basal ridge of penial sheath* with a small *projection*. *Process of penial sheath* well pronounced. *Aedeagus* comparatively slender, with a large *internal genital aperture*. *Setae of genital segment : Dorsally*, 3 setae always present on each side near the base of the style ; *ventrally*, 5–6 (5·2) smaller setae occur on each side of the penial sheath ; process of the penial sheath with 2–3 *setal sensilla*.

Material : 7 specimens examined, collected by Mr. A. I. Ezz and myself, on sugar cane, in Giza, Cairo, U.A.R., during the second and third weeks of August, 1964.

(B) *The apterous form* (Text-figs. 29 and 30).

Living specimens not available. The males are moderately robust, of medium size, with very short antennae and comparatively short legs. Mounted specimens 1120–1190 (1148)μ long and 308–350 (322)μ wide.

Body setae and *pores :* Antennae and legs with comparatively few, about 15μ long fleshy setae, and about 27μ long hair-like ones. The body itself only with hair-like setae, 31–49μ long ; each of abdominal segments VI, VII and VIII also with a rather long and stout seta on

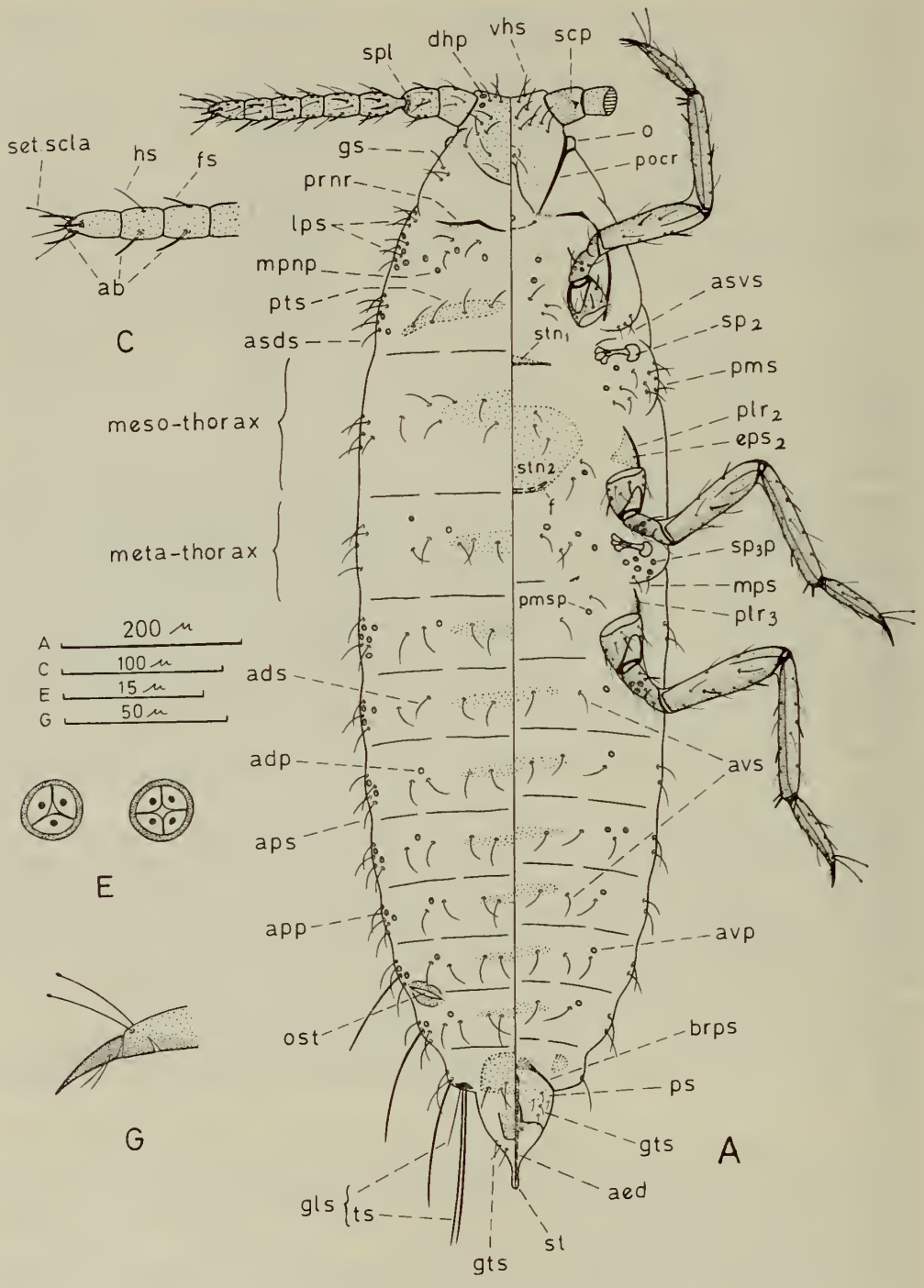


FIG. 29. *Saccharicoccus sacchari* (Cockerell), apterous form, dorsal and ventral view.

each side. Numerous quadrilocular, and occasionally trilocular pores, about 6μ in diameter, present on the head, thorax and abdomen.

Head with a narrow truncate apex, becoming broader posteriorly as it fuses with the thorax. Length from apex to postoccipital ridge 85–101 (95)μ and width across the genae 174–189 (180)μ. *Midcranial ridge* with its *dorsal, lateral* and *ventral arms* entirely absent. *Postoccipital ridge* V-shaped. *Dorsomedial part of epicranium* well sclerotized. *Ocular ridges* usually present, but sometimes atrophied or absent altogether. If present, the *preocular and interocular ridges* join the *postocular ridge* just below the ocellus. *Preoral ridge* weak. *Eyes : Dorsal* and *ventral simple eyes* absent ; lateral *ocelli* small. *Cranial apophysis* comparatively small, apically truncate. *Tentorial bridge* slender. *Dorsal head setae* 9–12 (10·5) on each side of the median line ; each gena always with 3 *genal setae*. *Ventral head setae* on each side : 7–9 (8·3) just anterior to the level of ocelli ; *posteriorly*, 0–1 (0·6) occur medially. *Head pores : Dorsal head pores* 2–4 (2·8) near the base of each antenna ; *ventral pores* absent.

Antennae : Filiform ; 8-segmented ; 256–293 (275)μ long, i.e. the ratio its length to the total body length 1 : 3·9–4·6 (4·2), and the ratio its length to the length of the hind leg 1 : 1·7–2·0 (1·8). *Scape* 40–46 (43)μ long and 37–43 (40)μ wide at base ; with 4–5 (4·2) h.s. *Pedicel* 37–40 (39)μ long and 31–34 (33)μ wide ; with 4–5 (4·5) f.s., 4–8 (5·8) h.s. and a *sensillum placodeum*. *Flagellar segments :* Segment III club-shaped and subequal in length to segment VIII (ratio 0·9–1·2, av. 1·1 : 1). Flagellar segments about 24μ wide, the ratio width to length of segments III and VII being 1 : 1·4–1·8 (1·8) and 1 : 1·2–1·3 (1·25), respectively. The lengths of the flagellar segments and the number of setae on each are given in the following table :

	III	IV	V	VI	VII	VIII
Length in μ	34–36	24–40	21–27	27–34	27–31	27–40
(av.)	(40)	(34)	(24)	(30)	(29)	(39)
f.s.	4–8	1–5	1–3	1–4	1–2	1–3
(av.)	(5·8)	(3·0)	(2·3)	(2·1)	(1·5)	(2·3)
h.s.	1–3	3–5	4–5	3–5	4–6	6–8
(av.)	(2·3)	(4·2)	(4·8)	(4·5)	(4·8)	(6·6)

Antennal bristles much stouter and longer than the antennal fleshy setae ; segments VI and

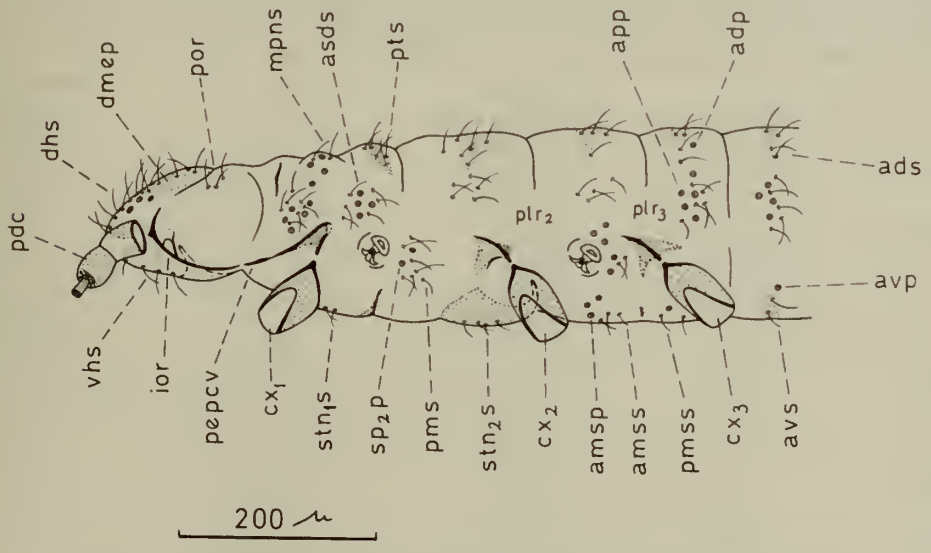


Fig. 30. *Saccharicoccus sacchari* (Cockerell), apterous form, lateral view.

VII each with a ventral bristle. Segment VIII with 3 preapical bristles, 2 capitate *subapical sensory setae* and 1 apical hair-like seta.

Thorax : Length from postoccipital ridge to first abdominal segment 418–441 (433)μ. *Prothorax : Pronotal ridges* usually weak or atrophied but sometimes well developed ; *pronotal sclerites* small. *Post-tergites* comparatively large. Dorsal margin of the *proepisternum* ridge-like. *Prosternum* small, triangular, 9–15 (12)μ long and 61–70 (65)μ wide ; *prosternal ridge* absent, and its position only marked by sclerotization. *Prothoracic setae* on each side : *Medial pronotal setae* 3–4 (3·3) ; *lateral pronotal setae* 7–9 (8·3) ; *post-tergital setae* 3–4 (3·8) ; *antespiracular dorsal setae* 5–7 (5·8). *Antespiracular ventral setae* 3–5 (3·4) ; *prosternal setae* 2–4 (2·8). *Prothoracic disc pores* on one side : *Medial pronotal pores* 3–4 (3·8) ; *lateral pronotal pores* 4–7 (5·3) ; *post-tergital pores* absent ; *antespiracular disc pores* 3–4 (3·3). *Prosternal pores* 2–3 (2·2).

Mesothorax : Largely reduced ; mesotergum represented by a weakly sclerotized sclerite. *Mesopleural ridge* atrophied ; *mesepisternum* distinct and *mesepimeron* small. *Basisternum* weakly sclerotized and hard to detect ; *marginal* and *precoxal ridges* absent ; *furca* vestigial. *Mesothoracic spiracle* 18–21 (20)μ wide at opening, with 49–55 (52)μ long supporting bar. *Mesothoracic setae* on each side : *Dorsal setae* 5–7 (6·2) forming on both sides a transverse band ; *pleural setae* 4–5 (4·5) ; *postmesostigmatal setae* 9–13 (11·3) behind each spiracle. *Basisternal setae* 3–5 (4·2). *Mesothoracic pores : Mesospiracular pores* 1–2 (1·5).

Metathorax : Metapleural ridge dorsally reduced ; *precoxal ridge* absent. *Metasternal apophyses* vestigial. *Metathoracic spiracle* similar to the mesothoracic. *Metathoracic setae* on each side : *Dorsal setae* 5–7 (5·8) ; *metapleural setae* 5–9 (6·8) ; *anterior metasternal setae* 2–4 (3·3) ; *posterior metasternal setae* always 2. *Metathoracic pores* on each side : *Dorsal pores* 1–2 (1·8) ; *metaspiracular pores* 5–8 (6·2) ; *anterior metasternal pores* 2–4 (3·1) and *posterior metasternal pores* 1–2 (1·3).

Legs : Comparatively short ; the ratio length of hind leg to total body length 1 : 2·3–2·4 (2·32). *Coxa* about 46 and *trochanter* about 24μ wide. *Femur* about 37μ wide ; that of the hind leg longest and those of the front and middle legs of about the same length ; the ratio width to length of the hind femur 1 : 3·8–4·0 (3·9). *Tibia* about 20μ wide ; with 2 apical spurs (smaller spines absent) ; the femur of fore leg always longer than the tibia, the ratio being 1·2–1·3 (1·21) : 1. Tarsus about 18μ wide ; *tarsal digitules* apically knobbed. *Claw* gradually tapering to a pointed end ; *ungual digitules* fine. The following table shows the lengths of the leg segments (in microns) and the number of setae on each :

		Fore leg	Middle leg	Hind leg
	length	37–43 (40)	37–43 (40)	40–46 (43)
Coxa	f.s.	1–3 (1·8)	1–3 (2·1)	1–2 (1·5)
	h.s.	4–7 (5·6)	5–8 (6·8)	5–8 (7·1)
	length	58–61 (60)	58–61 (60)	61–64 (63)
Trochanter	f.s.	0–1 (0·8)	0–1 (0·9)	1–2 (1·3)
	h.s.	3–5 (4·1)	3–5 (3·8)	4–6 (4·8)
	length	134–140 (137)	134–140 (137)	140–146 (143)
Femur	f.s.	2–3 (2·8)	1–3 (2·6)	2–4 (3·1)
	h.s.	5–8 (6·5)	5–8 (6·9)	6–9 (7·6)
	length	110–116 (113)	116–128 (122)	137–146 (140)
Tibia	f.s.	2–4 (3·2)	2–4 (3·4)	2–4 (3·3)
	h.s.	6–8 (6·9)	6–9 (7·5)	7–9 (8·2)
	length	64–70 (67)	64–70 (67)	70–76 (73)
Tarsus	f.s.	1–3 (2·3)	1–3 (2·6)	2–3 (2·4)
	h.s.	4–6 (5·3)	4–7 (6·1)	5–7 (6·4)
Claw	length	27–31 (29)	27–31 (29)	27–31 (29)
Total length of leg		436–461 (445)	445–473 (455)	482–503 (494)

Abdomen : Total length from first abdominal segment to projection of basal ridge of penial sheath 448–509 (479)μ, and width at third segment 289–342 (312)μ. Tergites and sternites of segments I–VII occurring as narrow median sclerotized areas ; tergite of segment VIII large and that of segments IX + X distinct ; sternites of segment VIII ill-defined. *Ostioles* well developed, 34–40 (37)μ long at orifice. *Abdominal setae* on each side : *Dorsal setae* 3–5 on segments I to VII and 2–4 on segment VIII. *Pleural setae* on segments I to VII and 3–4 on segment VIII, including one considerably long and stout seta on each of segments VI, VII and VIII. *Ventral setae* 1–3 on segment II, 2–4 on segments III to VII, and absent on segment VIII. *Abdominal pores :* Segments I to VII with 3–5 (4·2), 2–5 (2·9), 2–5 (2·8), 2–4 (2·7), 1–3 (2·1), 1–2 (1·8), and 0–1 (0·5) *pleural pores*, respectively. The segments also with 0–2 (0·8), 0–2 (0·4), 0–2 (0·5), 0–2 (0·5), 0–2 (1·2), 0–2 (0·9), 0–1 (0·3), and 0–1 (0·3) *dorsal pores*. One or two *ventral pores* present at least on one side of segments II to VI and sometimes also VII (averages 1·5, 1·3, 1·1, 1·3, 0·6, and 0·3, respectively).

Glandular pouch small ; *setae of glandular pouch* include a pair of 153–229 (180)μ long *tail setae*, and one seta, 61–76 (70)μ long, i.e. the ratio length of the tail setae to the total length of the body 1 : 5–7·8 (6·4). *Genital segment* identical with that of the macropterous males. *Penial sheath* 128–143 (140)μ long and 79–89 (82)μ wide, ratio 1·6–1·7 (1·68) : 1, and the ratio its length to the total body length 1 : 7·8–8·9 (8·2).

Material : 12 specimens examined, collected by B. S. Chandel, on sugar cane, in U.P. Bichpuri farm, Balawant Rajput College, Agra, United Provinces, India, during the summer of 1964 (received from Dr. D. J. Williams).

OCTOCOCCUS Group

OCTOCOCCUS Hall, 1939

Octococcus africanus (Brain)

(Text-figs. 31, 32)

Only winged forms known ; moderately robust, small, with very long antennae and long legs. Mounted specimens 882–1064 (966)μ long, 308–336 (322)μ wide and 2212–2534 (2366)μ wing expanse.

Body setae and *pores :* Antennae with numerous fleshy setae and a few hair-like ones, about 24μ long. The body itself and the legs with hair-like setae only. Quadrilocular and occasionally quinquelocular disc pores present only on the thorax and the first abdominal segment, about 6μ in diameter.

Head : Subtetrahedron ; subtriangular in dorsal and front views ; *ventral preocular depression* well pronounced in lateral view. Length from apex to postoccipital ridge 89–110 (101)μ ; from apex to neck 137–153 (146)μ ; width across the genae 165–192 (177)μ. *Dorsal arm of midcranial ridge* anteriorly separated from other arms and posteriorly fading out before reaching the postoccipital ridge. *Lateral* and *ventral arms* forming together a Y-shaped ridge. *Postoccipital ridge* not reaching the preocular ridges. *Preocular* and *interocular ridges* joined ; the former with a hardly indicated ventral rudiment below the articular process. *Postocular ridge* well developed and *preoral ridge* slender. *Eyes : Dorsal simple eyes* slightly projecting beyond the outer margins of the head in dorsal view ; their corneae 18–21 (20)μ in diameter and separated by 92–119 (104)μ, i.e. 4·4–6·0 (5·1) times their diameter apart. *Ventral simple eyes* 15–21 (18)μ in diameter and 24–31 (27)μ apart. Lateral *ocelli* large. *Cranial apophysis* comparatively short and apically truncate. *Tentorial bridge* slender. *Dorsal head setae* 5–7 (5·9) on each side anterior to the postoccipital ridge ; each gena always with 3 *genal setae*. *Ventral head setae* on each side : Setae between the ventral eyes absent ; 3–4 (3·6) setae in the

area of the ventral preocular depression, forming on both sides a transverse irregular row ; 2–3 (2·2) setae on each side of the ventral arm of the midcranial ridge. *Head disc pores* entirely absent.

Antennae : Filiform ; normally 10-segmented ; 668–769 (729)μ long, i.e. much longer than half the total body length (ratio 1 : 1·2–1·6, av. 1·3), and longer than the hind legs (ratio 1·1–1·3, av. 1·2 : 1). *Scape* 43–49 (46)μ long and 46–49 (47)μ wide at base ; almost always with 4, and occasionally 5 h.s. (av. 4·1). *Pedicel* 58–64 (61)μ long and 37–40 (38)μ wide ; with 10–18 (13·1) f.s., 3–8 (5·3) h.s. and a *sensillum placodeum.* Flagellar segments with a few apically knobbed, about 40μ long *capitate sensory setae.* Segment III club-shaped, longest of all and about 27μ wide, the ratio its length to the length of segment X 1·2–1·4 (1·3) : 1, and the ratio its width to its length 1 : 3·1–3·7 (3·3). Segments IV to X slightly narrower, the ratio width to length of segment IX being 1 : 2·7–3·3 (3·0). The lengths of the flagellar segments and the number of setae on each are given in the following table :

	III	IV	V	VI	VII	VIII	IX	X
length in μ	85–101	67–82	70–82	70–85	67–82	70–85	64–79	70–73
(av.)	(92)	(76)	(79)	(82)	(76)	(79)	(73)	(71)
f.s.	12–19	10–20	10–19	13–20	13–20	12–21	14–20	13–16
(av.)	(15·6)	(14·6)	(14·1)	(16·3)	(17·8)	(18·4)	(17·9)	(14·7)
h.s.	2–4	0	0	0	0	0	0	0
(av.)	(3·4)	0	0	0	0	0	0	0
set. ca.	1–2	2–3	1–2	3–4	4–5	5–6	4–6	4
(av.)	(1·6)	(2·7)	(1·3)	(3·7)	(4·4)	(5·3)	(5·1)	(4·0)

Antennal bristles inconsiderably stouter than the fleshy setae ; segments VIII and IX each with a ventral bristle. Terminal segment with 3 preapical bristles and 1–2 apical *sensilla basiconica.*

Thorax : 418–479 (448)μ long. *Prothorax : Pronotal ridges* medially interrupted by a weak sclerotization. *Lateral pronotal sclerites* and *post-tergites* distinct. Dorsal margin of *pro-episternum* ridge-like. *Prosternum* triangular, 12–18 (15)μ long ; posteriorly bounded by the transverse, 82–98 (92)μ long *prosternal ridge. Prothoracic setae* on each side : *Medial pronotal setae* absent ; *lateral pronotal seta* 0–1 (0·3) ; *post-tergital* and *antespiracular dorsal setae* absent. One *antespiracular ventral seta* always present ; *prosternal setae* almost always absent although one seta may occur on one side (av. 0·2). *Prothoracic disc pores* on each side : *Medial* and *lateral pronotal pores* 0–1 (0·8) and 0–2 (0·9) respectively ; *antespiracular dorsal pores* absent. *Prosternal pores* 1–2 (1·3).

Mesothorax : Prescutum 67–79 (73)μ long and 116–137 (128)μ wide, the ratio being 1 : 1·6–1·9 (1·8) ; laterally and posteriorly bounded by the *prescutal ridge* and the *prescutal suture. Scutum* well sclerotized antero-laterally and with a median longitudinal membranous narrow area ; 73–89 (76)μ long, i.e. the ratio lengths of prescutum to scutum 1 : 1·0–1·2 (1·1). *Prealare, prealar ridge, triangular plate, anterior* and *posterior notal wing processes* well developed. *Scutellum* 49–61 (55)μ long and 82–104 (92)μ wide, i.e. the ratio 1 : 1·6–1·8 (1·7), and the ratio its length to the length of the scutum 1 : 1·3–1·5 (1·4). *Postalare* with well separated *anterior* and *posterior postalar ridges. Postnotal apophysis* strong. *Mesopleuron : Mesopleural ridge* interrupted above the coxal articulation ; *basalare* comparatively slender. *Mesepisternum* and *mesepimeron* distinct ; *lateropleurite* narrow. *Mesosternum : Basisternum* 113–134 (122)μ long and 189–232 (204)μ wide ; bounded by the *marginal* and the *precoxal ridges ; furca* well developed. *Mesothoracic spiracle* 21–24 (23)μ wide at opening, with a 40–46 (43)μ long supporting bar. *Mesothoracic setae* on each side : *Prescutal setae* 2–4 (3·1) ; *scutal setae* 4–6 (4·9) ; *scutellar setae* 2–3 (2·4). One *tegular seta* always present. *Postmesostigmatal setae* 2–4 (3·1) behind the spiracles, and one medially separated. *Basisternal setae* 5–7 (5·3). *Meso-thoracic disc pores : Mesospiracular pores* 1–2 (1·1) ; *postmesostigmatal pores* absent.

Metathorax : Metapostnotal sclerites well defined and *metapostnotal ridge* weakly developed.

Metapleural ridge attenuated at the point of origin of the *metapleural apophysis*. *Precoxal ridge* well developed and *metasternal apophysis* distinct. *Metathoracic spiracle* similar to the mesothoracic. *Metathoracic setae* on each side : *Metatergal setae* always 3 ; *metapleural setae* 0–1 (0·4). *Anterior metasternal setae* usually 1 and occasionally 2 (av. 1·1) ; *posterior metasternal setae* 0–1 (0·1). *Metathoracic pores :* One *metaspiracular pore* always present behind each spiracle.

Wings : 966–1120 (1036)μ long and 392–462 (420)μ wide ; with 2 *alar setae* and 2 minute *circular sensoria*. *Hamulohalterae* 79–85 (82)μ long and 18–21 (19)μ wide ; with a 52–61 (55)μ long apically hooked seta, i.e. the ratio lengths of seta to hamulohaltera 1 : 1·4–1·6 (1·5).

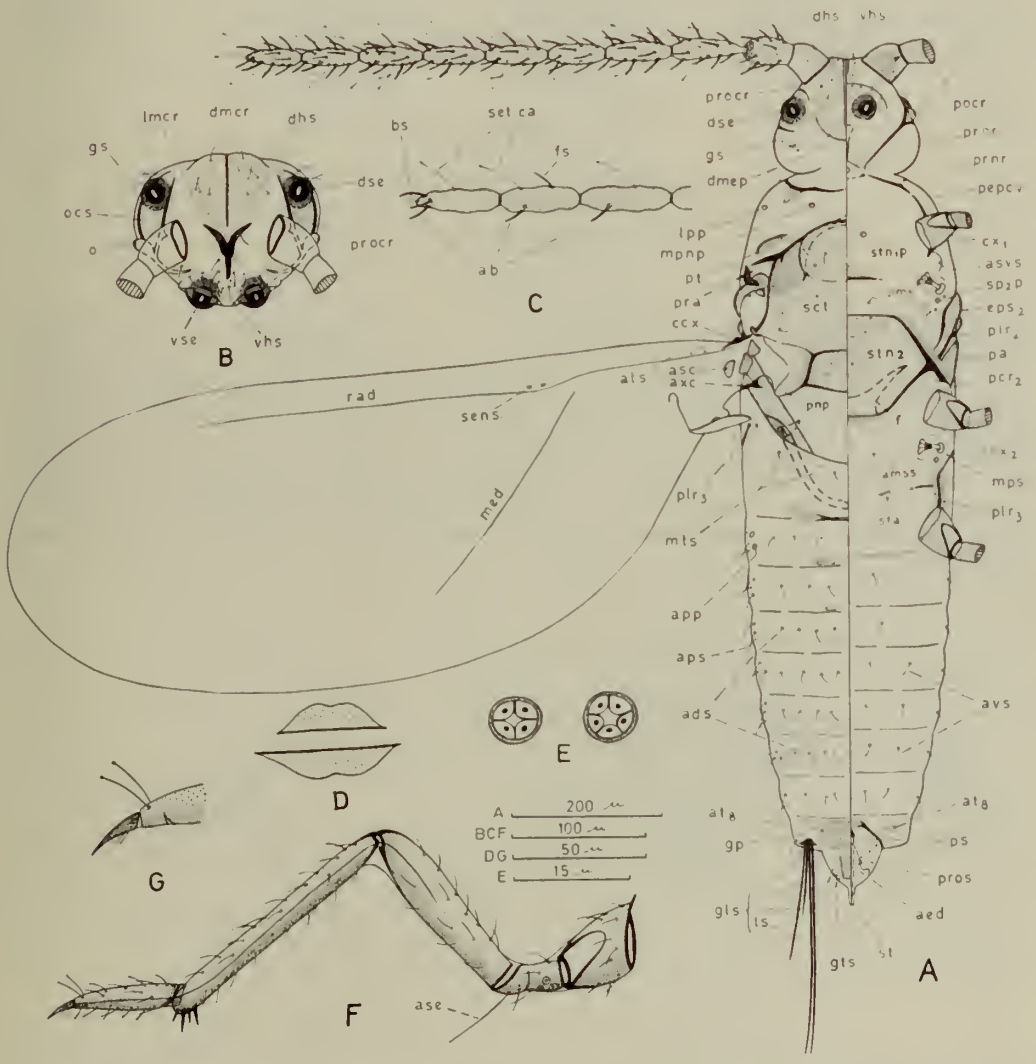


FIG. 31. *Octococcus africanus* (Brain), dorsal and ventral view.

Legs : Comparatively long and stout ; the ratio length of the hind leg to the total body length 1 : 1·5–1·7 (1·6). *Coxa* about 55 and *trochanter* about 27μ wide ; the latter with a differentiated long *apical seta*. *Femur* about 40μ wide ; that of the fore leg longest and that of the middle leg shortest ; the ratio width to length of the hind femur 1 : 3·7–4·2 (4·0). *Tibia* about 24μ wide ; with 2 apical strong spurs and 2–3 smaller spines ; in fore legs the femur usually shorter and sometimes as long as the tibia, the ratio their lengths being 1 : 1–1·1 (1·06). *Tarsus* about 21μ wide ; *tarsal digitules* apically knobbed, about 37μ long. *Claw* gradually tapering to a pointed end ; *ungual digitules* fine. The following table shows the lengths of the leg segments (in microns) and the number of setae on each :

		Fore leg	Middle leg	Hind leg
Coxa	length	43–49 (46)	43–49 (46)	46–52 (49)
	h.s.	8–12 (9·3)	8–13 (10·4)	9–12 (10·5)
Trochanter	length	58–67 (61)	58–67 (61)	61–70 (66)
	h.s.	4–6 (4·8)	4–7 (5·2)	5–7 (5·4)
Femur	length	162–174 (168)	143–159 (153)	150–165 (159)
	h.s.	19–25 (21·3)	14–20 (17·2)	15–21 (17·8)
Tibia	length	162–189 (177)	177–211 (189)	198–232 (214)
	h.s.	20–27 (23·5)	21–29 (24·7)	23–30 (27·1)
Tarsus	length	76–82 (79)	76–82 (79)	79–85 (82)
	h.s.	13–18 (15·4)	15–18 (16·9)	16–20 (18·1)
Claw	length	00–00 (24)	00–00 (24)	00–00 (24)
Total length of leg		522–580 (555)	525–586 (555)	561–619 (592)

Abdomen : 266–334 (296)μ long and 289–327 (312)μ wide. Tergites of segments I and II small ; those of segments VIII and IX + X large and distinct. Sternites of segment VIII ill-defined. *Ostioles* entirely absent. *Abdominal setae* on each side : *Dorsal setae* 2–3 on segment I, 3–4 on segments II to VI, 2–3 on segment VII, and 1–2 on segment VIII. *Pleural setae* 2–3 on segment I, 3–4 on segments II to VII, and always 1 on segment VIII. *Ventral setae* 1 on segment II, 1–2 on segment III, 2–3 on segments IV to VII, and absent on segment VIII. *Abdominal pores :* Segment with 1–3 (2·6) *pleural pores* on each side ; other abdominal pores entirely absent.

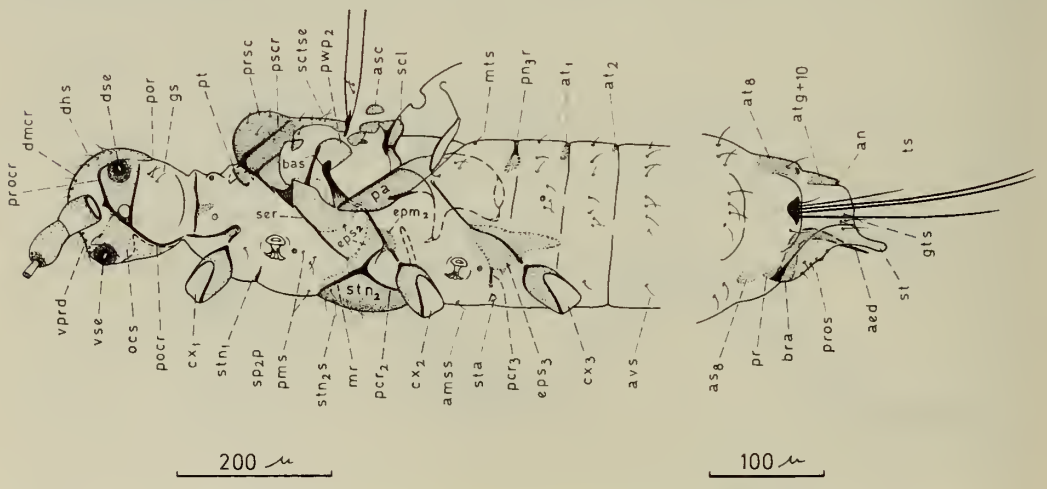


FIG. 32. *Octococcus africanus* (Brain). lateral view.

Glandular pouches well developed ; *setae of glandular pouch* consist of a pair of 229–275 (256)μ long *tail setae*, and a pair of shorter setae of unequal lengths, 159–183 (171) and 70–116 (82)μ long respectively, and a short one, subequal in length to the abdominal setae ; the ratio length of tail setae to total body length being 1 : 3·4–4·2 (3·8). *Genital segment* small, subtriangular in dorsal view. *Style* rather straight in lateral view, with a rounded apex. *Penial sheath* 104–116 (110)μ long and 76–92 (85)μ wide, the ratio being 1·1–1·5 (1·3) : 1 and the ratio its length to total body length 1 : 8·1–10·0 (8·9). *Basal ridge* of the penial sheath and its *projection* well developed. *Process of penial sheath* hardly indicated. *Aedeagus* broad gradually tapering dorso-posteriorly. *Setae of genital segment* on each side : *Dorsally* 4 setae always present near the base of the style ; *ventrally* 2–4 (2·6) setae occur on the penial sheath and 3–4 small *setal sensilla* on its process.

Material : 10 specimens examined, collected by O. W. Richards, on *Nolletia* sp., in Colesberg bridge (over Orange River), Cape Province, South Africa, on 26.ix.1952.

CEROPUTO Group

CEROPUTO Šulc, 1898

Ceroputo pilosellae Šulc

(Text-figs. 33, 34)

Macropterous forms only known ; narrow and slender, of medium size, with comparatively very long antennae and moderately long legs. Mounted specimens 938–1260 (1106)μ long, 266–322 (294)μ wide at mesothorax and 2254–2506 (2366)μ wing expanse.

Body setae and *pores :* Body and appendages with numerous hair-like setae ; fleshy setae entirely absent. Antennal setae about 61μ long, body setae about 24μ long and leg setae of intermediate length. Quadrilocular and occasionally quinquelocular disc pores present on head, thorax and abdomen, about 6μ in diameter.

Head : Subtetrahedron ; subtriangular in dorsal and front views ; *ventral preocular depression* well pronounced in lateral view. Length from apex to postoccipital ridge 98–122 (104)μ ; from apex to neck 143–165 (153)μ ; width across the genae 159–198 (180)μ. *Dorsal arm of midcranial ridge* absent, though its position marked by a sclerotization ; anteriorly continuous with the ventral arm and posteriorly fading out before reaching the postoccipital ridge. *Lateral* and *ventral arms* well developed. *Postoccipital ridge* indicated by a slender, U-shaped sclerotization, anteriorly confluent with the preocular ridges. *Dorsomedial part of epicranium* slightly raised. *Preocular ridge* widely separated from *postocular ridge ; inter-ocular ridge* absent ; *preoral ridge* slender. *Eyes : Dorsal simple eyes* projecting beyond the outer margins of the head in dorsal view ; the diameter of their corneae 15–21 (17)μ, and separated by 107–137 (122)μ, i.e. 5·4–9·0 (6·9) times their diameter apart. *Ventral eyes* also 15–21 (19)μ in diameter and 31–46 (37)μ apart. Lateral *ocelli* well developed, attached to the postocular ridges by means of a short sclerotized arm. *Ocular sclerites* large. *Cranial apophysis* apically truncate ; *tentorial bridge* slender. *Dorsal head setae* on each side 8–11 (9·7) anterior to the postoccipital ridge ; each gena almost always with 3 and occasionally 2 (av. 2·8) *genal setae*. *Ventral head setae* on each side : 1–2 (1·5) between the ventral eyes ; 6–9 (7·0) in the area of the ventral preocular depression forming on both sides a transverse band ; 2–3 (2·8) on each side of the ventral arm of the midcranial ridge. *Head disc pores : Dorsal pores* absent ; one *ventral pore* always present on each side.

Antennae : Filiform ; 10-segmented ; 760–970 (878)μ long, i.e. much longer than half the body length (ratio 1 : 1·2–1·3, av. 1·25) and longer than the hind legs (ratio 1·2–1·4, av. 1·3 : 1). *Scape* 46–52 (49)μ long and 43–47 (46)μ wide at base ; always with 4 h.s. *Pedicel* 58–64 (61)μ

long and 31–37 (34)μ wide ; with 8–16 (11·3) h.s. and a *sensillum placodeum*. *Flagellum :* Flagellar segments cylindrical and about 21μ wide. Segment III longest of all, the ratio its length to the length of segment X 1·6–2·1 (1·8) : 1, and the ratio width to length of segments III and IX 1 : 5·4–7·1 (6·4) and 1 : 3·6–4·5 (4·2), respectively. The following table shows the lengths of the flagellar segments and the number of setae on each:

	III	IV	V	VI	VII	VIII	IX	X
length in μ	116–153	95–131	92–119	76–113	73–95	67–85	70–82	61–85
(av.)	(137)	(113)	(107)	(98)	(85)	(76)	(76)	(76)
h.s.	17–28	10–18	10–15	9–14	9–13	9–12	8–15	12–18
(av.)	(22·8)	(14·1)	(12·5)	(11·0)	(10·7)	(10·1)	(11·1)	(15·6)

Antennal bristles inconsiderably stouter than the antennal setae and slightly shorter ; segments VIII and IX each with one ventral bristle. Segment X with three preapical bristles and 2–3 preapical *sensilla basiconica*. Capitate, apically knobbed setae entirely absent.

Thorax : 388–479 (433)μ long. *Prothorax : Pronotal ridges* medially interrupted. *Lateral pronotal sclerites* and *post-tergites* small. Dorsal and ventral margins of the *proepisternum* with ridge-like sclerotizations (fig. 31). *Prosternum* triangular, 24–31 (27)μ long ; posteriorly supported by the transverse, 82–98 (89)μ long *prosternal ridge*. *Prothoracic setae : Medial pronotal, lateral pronotal, post-tergital* and *antespiracular dorsal setae* all absent ; one *antespiracular ventral seta* always present on each side. *Prosternal setae* usually absent, but one seta was found on one side of one specimen. *Prothoracic pores* on each side : *Medial pronotal pores* 2–4 (3·1) ; *lateral pronotal pores* 1–2 (1·3) ; *antespiracular dorsal pores* absent. *Prosternal pores* usually 1–2, and sometimes absent on one side (av. 1·1).

Mesothorax : Prescutum triangular in dorsal view ; 76–98 (85)μ long and 92–119 (104)μ wide, the ratio being 1 : 1·1–1·3 (1·2). *Prescutal ridges* continuous postero-medially replacing the *prescutal suture*. *Scutum* very short and evenly sclerotized ; 27–46 (37)μ long, i.e. the ratio lengths of prescutum to scutum 2·0–3·2 (2·3) : 1. *Prealare, prealar ridge, triangular plate, tegula, anterior* and *posterior notal wing processes* well developed. *Scutellum* 58–73 (64)μ long and 79–110 (92)μ wide, the ratio being 1 : 1·3–1·5 (1·4), and the ratio its length to the length of scutum 1·4–2·2 (1·8) : 1. *Postalare* with well separated *anterior* and *posterior postalar ridges*. *Postnotal apophysis* strong. *Mesopleuron : Mesopleural ridge* interrupted above the coxal articulation ; *basalare* comparatively slender. *Mesepisternum* and *mesepimeron* well defined ; *lateropleurite* moderately large. *Mesosternum : Basisternum* 101–128 (116)μ long and 162–198 (180)μ wide ; *marginal, precoxal ridges* and *furca* well developed. *Mesothoracic spiracle* 21–24 (23)μ wide at opening, with a 37–43 (40)μ long supporting bar. *Mesothoracic setae* on each side : *Prescutal setae* usually 2 and occasionally 3 (av. 2·2) ; *scutal setae* 4–5 (4·5) ; *scutellar setae* 1–2 (1·3). *Tegular setae* 1–4 (2·5). *Postmesostigmatal setae* 3–5 (3·7) in a latero-ventral group. *Basisternal setae* 6–8 (7·2). *Mesothoracic disc pores* on each side ; *Mesospiracular pores* 1–2 (1·6) ; *postmesostigmatal pores* 1–2 (1·2).

Metathorax : Metapostnotal sclerites distinct and *metapostnotal ridge* weakly developed. *Metapleural ridge* attenuating near the middle ; with a small *metapleural wing process*. *Precoxal ridge* weak ; *metepisternum, metepimeron* and *metasternal apophysis* distinct. *Metathoracic spiracle* identical with the mesothoracic. *Metathoracic setae* on each side : *Metatergal setae* 2–3 (2·5) ; *metapleural setae* 0–1 (0·1). *Anterior metasternal setae* always one, and *posterior metasternal setae* 0–2 (0·9). *Metathoracic disc pores* on each side : *Metatergal pores* 1–2 (1·3) ; *metaspiracular pores* 1–2 (1·1). *Anterior metasternal pores* 1–2 (1·3) and *posterior metasternal pores* 0–1 (0·4).

Wings : 1008–1134 (1078)μ long and 378–448 (406)μ wide ; with 2–3 (2·8) *alar setae* and a compact row of 2 minute *circular sensoria*. *Hamulohalterae* 79–98 (85)μ long and 21–24 (23)μ wide ; with one, 49–55 (52)μ long apically hooked seta, i.e. the ratio lengths of seta to hamulohaltera 1 : 1·5–1·9 (1·7).

Legs : Well developed and moderately long ; the middle legs shortest and the hind legs longest ; the ratio length of the hind leg to the total body length 1 : 1·5–1·7 (1·6). *Coxa* about 49 and *trochanter* about 24μ wide. *Femur* about 34μ wide ; that of the fore leg longest and that of the middle leg shortest ; the ratio width to length of the hind femur 1 : 4·7–5·8 (5·1). *Tibia* about 21μ wide ; with 2 apical spurs ; in fore leg the femur shorter than the tibia, the ratio their lengths 1 : 1·2–1·4 (1·3). *Tarsus* about 18μ wide ; *tarsal digitules* absent. *Claw*

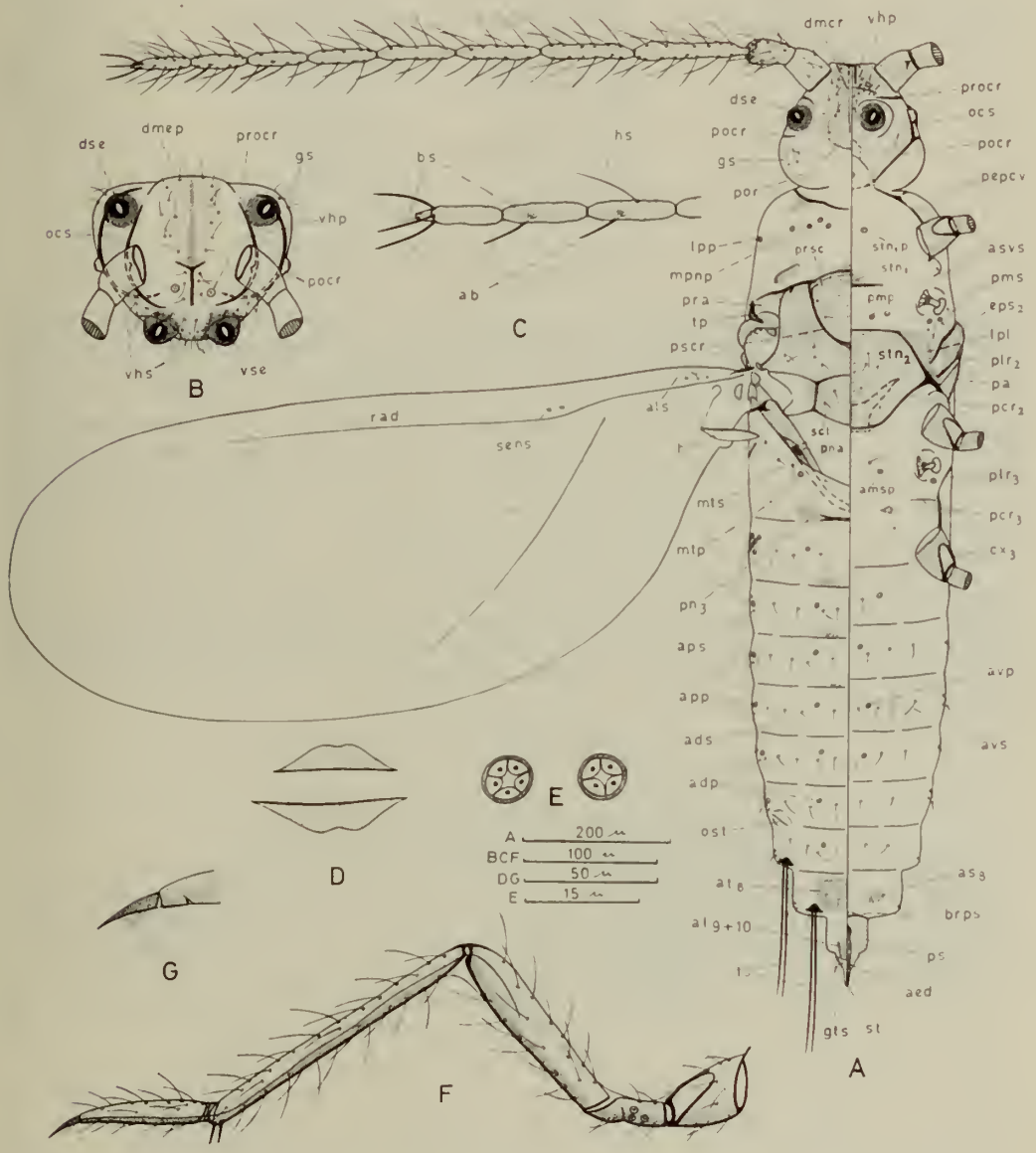


FIG. 33. *Ceroputo pilosellae* Šulc, dorsal and ventral view.

uniformly tapering to a sharply pointed apex ; *ungual digitules* fine, about 12μ long. The following table shows the lengths of the leg segments (in microns) and the number of setae on each:

		Fore leg	Middle leg	Hind leg
Coxa	length	40–46 (43)	40–46 (43)	43–49 (46)
	h.s.	11–14 (12·8)	11–15 (13·2)	13–16 (13·8)
Trochanter	length	55–61 (58)	55–61 (58)	58–64 (61)
	h.s.	5–8 (6·7)	5–8 (6·8)	6–9 (7·3)
Femur	length	174–217 (198)	153–201 (180)	159–211 (186)
	h.s.	34–42 (36·8)	26–35 (30·9)	27–38 (30·4)
Tibia	length	235–290 (256)	226–284 (247)	238–299 (265)
	h.s.	35–46 (41·1)	36–44 (39·5)	37–49 (42·4)
Tarsus	length	89–107 (98)	89–107 (98)	92–110 (101)
	h.s.	26–31 (28·8)	26–33 (29·5)	28–35 (30·5)
Claw	length	27–34 (31)	27–34 (31)	27–34 (31)
Total length of leg		619–750 (680)	589–729 (653)	622–766 (692)

Abdomen : 357–562 (464)μ long and 258–304 (281)μ wide. Tergites of segments I, II and sometimes III small ; those of segments VIII and IX + X distinct. *Ostioles* ill-defined. *Abdominal setae* on each side : *Dorsal setae* 2–4 on segment I, 3–5 on segments II and III, 3–4 on segments IV to VII, and 2 on segment VIII. *Pleural setae* 1–2 on segment I, 2–3 on segment II, 3–5 on segments III to VII, and always 3 on segment VIII. *Ventral setae* 1 on segment II, 3–4 on segments III and IV, 2–3 on segments V to VII, and absent on segment VIII. *Abdominal pores : Pleural pores* 3–5 (4·1), 1–2 (1·1), (1·0), 1–2 (1·1), (1·0), and (1·0) on segments I to VI, respectively. Segments I to VII also with 0–1 (0·6), 1–2 (1·2), 1–2 (1·1), 0–2 (0·9), 0–1 (0·9), and 0–1 (0·8) *dorsal pores*, and segments II to VI with 0–2 (0·6), 0–2 (0·7), 0–1 (0·5), 0–1 (0·3), and 0–1 (0·1) *ventral pores*, respectively.

Glandular pouches well developed, occurring on each side of segments VII and VIII. *Setae of glandular pouch* of segment VII include a pair of 168–207 (177)μ long *tail setae* ; those of segment VIII include a pair of 189–223 (204)μ long tail setae, and one seta about as long as the abdominal setae, i.e. the ratio length of the tail setae of segment VIII to the total body length 1 : 4·7–6·4 (5·4).

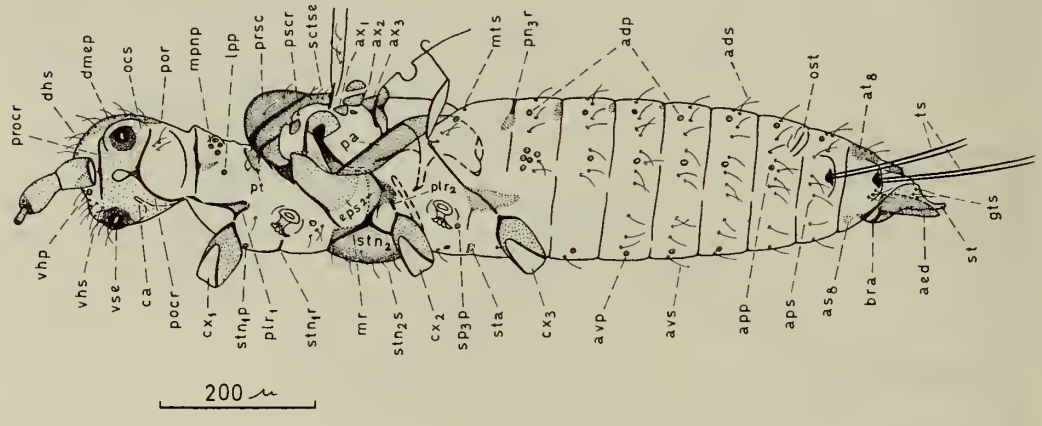


FIG. 34. *Ceroputo pilosellae* Šulc, lateral view.

Genital segment comparatively small ; *style* rather straight in lateral view, with rounded apex. *Penial sheath* 92–107 (98)μ long and 49–61 (55)μ wide, i.e. the ratio length to width 1·6–2·1 (1·8) : 1, and the ratio its length to the total body length 1 : 10·2–12·6 (11·3). *Basal ridge of penial sheath* slender and its *projection* small. *Process of penial sheath* absent. *Aedeagus* comparatively stout and short. *Setae of genital segment : Dorsally* 3 setae always present on each side near the base of the style ; *ventral* setae absent, but 0–3 (1·1) *setal sensilla* occur on each side of the penial sheath.

Material : 10 specimens examined, collected by N. Mitic-Muzina, on *Fragaria vesca*, in Belgrade, Yugoslavia, 30.ix.1961.

CENTROCOCCUS Borchsenius, 1948

Centrococcus insolitus (Green)

(Text-figs. 35, 36)

Macropterous forms only known ; moderately robust, large, with comparatively very long antennae and long and slender legs. When mounted, the total length of the body 1302–1512 (1386)μ, width at mesothorax 350–392 (378)μ and wing expanse 3136–3556 (3374)μ.

Body setae and *pores :* Antennae with numerous, about 60μ long fleshy setae and a few, about 24μ long, hair-like ones ; the legs also with fleshy (about 40μ long) and hair-like setae. The body itself with hair-like setae only. Quadrilocular and occasionally trilocular disc pores present on the head, thorax and abdomen, about 6μ in diameter.

Head : Subtetrahedron ; subtriangular in dorsal and front views ; *ventral preocular depression* well pronounced in lateral view. Length from apex to postoccipital ridge 128–146 (137)μ ; from apex to neck 183–201 (192)μ ; width across the genae 211–238 (220)μ. *Dorsal arm of midcranial ridge* anteriorly continuous with the short *ventral arm*, and posteriorly meeting the postoccipital ridge. *Lateral arms* only indicated by short sclerotizations. *Postoccipital ridge* anteriorly confluent with the preocular ridges. *Preocular ridge* completely separated from the *postocular ridge*. *Interocular ridge* replaced by a short arm attached to the postocular ridge, and dorsally supporting the ocellus. *Preoral ridge* slender. *Eyes : Dorsal simple eyes* projecting beyond the outer margins of the head in dorsal view ; their corneae 27–34 (31)μ in diameter and separated by 122–156 (137)μ, i.e. 3·7–5·7 (4·5) times their diameter apart. *Ventral simple eyes* 31–43 (37)μ in diameter and 27–43 (34)μ apart. Lateral *ocelli* well developed, dorsally supported by the ridge-like arm as mentioned. *Cranial apophysis* apically truncate. *Tentorial bridge* slender. *Dorsal head setae* 7–12 (9·8) on each side anterior to the postoccipital ridge ; each gena usually with 1–3 *genal setae*, but in few specimens the setae of either gena were absent (av. 1·6). *Ventral head setae* on each side : Setae between the ventral eyes absent ; 5–8 (6·2) in the area of the ventral preocular depression, forming on both sides a transverse band ; 2–3 (2·3) on each side of the ventral arm of the midcranial ridge. *Head disc pores :* One *dorsal* and one *ventral head pore* usually present a least on one side of the dorsal and ventral arms of the midcranial ridge (averages 0·6 and 0·9 respectively).

Antennae : Filiform ; 10-segmented ; 875–1254 (1095)μ long, i.e. longer than half the total length of the body (ratio 1 : 1·1–1·5, av. 1·3), and longer than the hind legs (ratio 1·1–1·3, av. 1·2 : 1). *Scape* 61–64 (63)μ long and 52–58 (55)μ wide at base ; always with 4 h.s. *Pedicel* 61–73 (67)μ long and 37–40 (39)μ wide ; with 6–11 (7·3) f.s., 4–8 (5·3) h.s. and a *sensillum placodeum*. Flagellar segments cylindrical, about 21μ wide. Segment III longest of all, the ratio lengths of segments III to X being 1·4–1·9 (1·6) : 1, and the ratio width to length

of segments III and IX 5·3–7·4 (6·5) : 1 and 3·7–5·1 (4·4) : 1, respectively. In the following table the lengths of the flagellar segments and the number of setae on each are given :

	III	IV	V	VI	VII	VIII	IX	X
length in μ	128–180	101–165	98–168	92–153	85–134	82-122	79–110	85–116
(av.)	(159)	(137)	(137)	(128)	(116)	(107)	(95)	(98)
f.s.	15–21	11–19	13–21	11–21	12–16	13–17	12–14	10–15
(av.)	(18·3)	(14·3)	(17·5)	(16·1)	(14·6)	(14·3)	(13·2)	(13·0)
h.s.	5–8	1–3	1–3	1–2	1–2	1–2	1–2	1–2
(av.)	(7·1)	(1·6)	(1·9)	(1·2)	(1·3)	(1·1)	(1·2)	(1,4)

Antennal bristles inconsiderably stouter than the fleshy setae. Segments VIII and IX each with a ventral bristle, about 31μ long. Segment X with 3 preapical bristles, about 55μ long and two much shorter ventral ones, about 18μ long, at a greater distance from the segment's apex ; terminal segment also with a preapical *sensilla basiconica*. Capitate, apically knobbed *sensory setae* entirely absent.

Thorax : 532–623 (562)μ long. *Prothorax : Pronotal ridges* medially interrupted as usual. *Lateral pronotal sclerites* and *post-tergites* well defined. Dorsal and ventral margins of the *proepisternum* ridge-like. *Prosternum* represented by a small plate on each side of the median line ; *prosternal ridge* 107–128 (116)μ long. *Prothoracic setae* on each side : *Medial* and *lateral pronotal setae* usually absent, but one seta of each was observed on one side of one specimen ; *post-tergital setae* 0–2 (0·5) ; *antespiracular dorsal setae* absent. One *antespiracular ventral seta* always present ; *prosternal setae* 0–1 (0·3). *Prothoracic disc pores* on each side : *Medial* and *lateral pronotal pores* 1–3 (averages 1·4 and 2·1, respectively) ; *antespiracular dorsal pores* absent. *Prosternal pores* 1–3 (1·7).

Mesothorax : Prescutum 122–162 (140)μ long and 131–146 (137)μ wide, the ratio being 1 : 0·9–1·1 (1·0). *Prescutal ridges* well developed and continuous medially, replacing the *prescutal suture*. *Scutum* comparatively very short and evenly sclerotized ; 21–31 (27)μ long, i.e. the ratio lengths of prescutum to scutum 4·3–6·4 (5·1) : 1. *Prealare, prealar ridge, triangular plate, tegular, anterior* and *posterior notal wing processes* well developed. *Scutellum* laterally supported by a strong additional ridge ; 85–101 (92)μ long and 131–143 (137)μ wide, i.e. the ratio length to width 1 : 1·4–1·7 (1·5), and the ratio lengths of scutellum to scutum 3·0–4·0 (3·3) : 1. *Postalare* with well separated *anterior* and *posterior postalar ridges*. *Mesopleuron : Mesopleural ridge* interrupted above the coxal articulation ; *basalare* comparatively slender. *Mesepisternum* and *mesepimeron* well defined ; *lateropleurite* moderately large, with a distinct oval semi-membranous area. *Mesosternum : Basisternum* 146–183 (165)μ long and 226–250 (235)μ wide ; *marginal, precoxal ridges* and *furca* well developed. *Mesothoracic spiracle* 21–24 (23)μ wide at opening, with a 43–49 (46)μ long supporting bar. *Mesothoracic setae* on each side : *Prescutal setae* 6–9 (7·2) ; *scutal setae* 2–4 (2·9) ; *scutellar setae* 1–2 (1·8). *Tegular setae* 3–6 (4·7). *Postmesostigmatal setae* 1–3 (1·3) occurring sublaterally. *Basisternal setae* 8–16 (11·6). *Mesothoracic disc pores : Mesospiracular pores* 2–4 (2·6) ; *postmesostigmatal pores* absent.

Metathorax : Metapostnotal sclerites well defined ; *metapostnotal ridge* weakly developed. *Metapleural ridge* attenuated near the middle as usual. *Precoxal ridge* weakly developed, and *metasternal apophysis* distinct. *Metathoracic spiracle* identical with the mesothoracic. *Metathoracic setae* on each side : *Metatergal setae* 3–4 (3·2) ; *metapleural setae* 1–2 (1·1). *Anterior metasternal setae* 0–1 (0·8) ; *posterior metasternal setae* 0–2 (0·9). *Metathoracic pores* on each side : *Metaspiracular pores* 1–2 (1·3) ; *anterior metasternal pores* 0–2 (1·2) ; *posterior metasternal pores* 0–1 (0·3).

Wings : 1400–1610 (1484)μ long and 462–546 (504)μ wide ; with 2–3 (2·3) *alar setae* and a compact row of 2–3 (2·2) minute *circular sensoria*. *Hamulohalterae* 113–122 (119)μ long and 21–24 (23)μ wide ; with one, 52–61 (55)μ long apically hooked seta, i.e. the ratio lengths of seta to hamulohaltera 1 : 1·9–2·3 (2·2).

Legs : Comparatively long and slender ; the middle legs shortest and the hind legs longest ; the ratio length of the hind leg to the total length of the body 1 : 1·2–1·6 (1·4). *Coxa* and *trochanter* about 58 and 31μ wide respectively. *Femur* about 40μ wide ; that of the fore leg

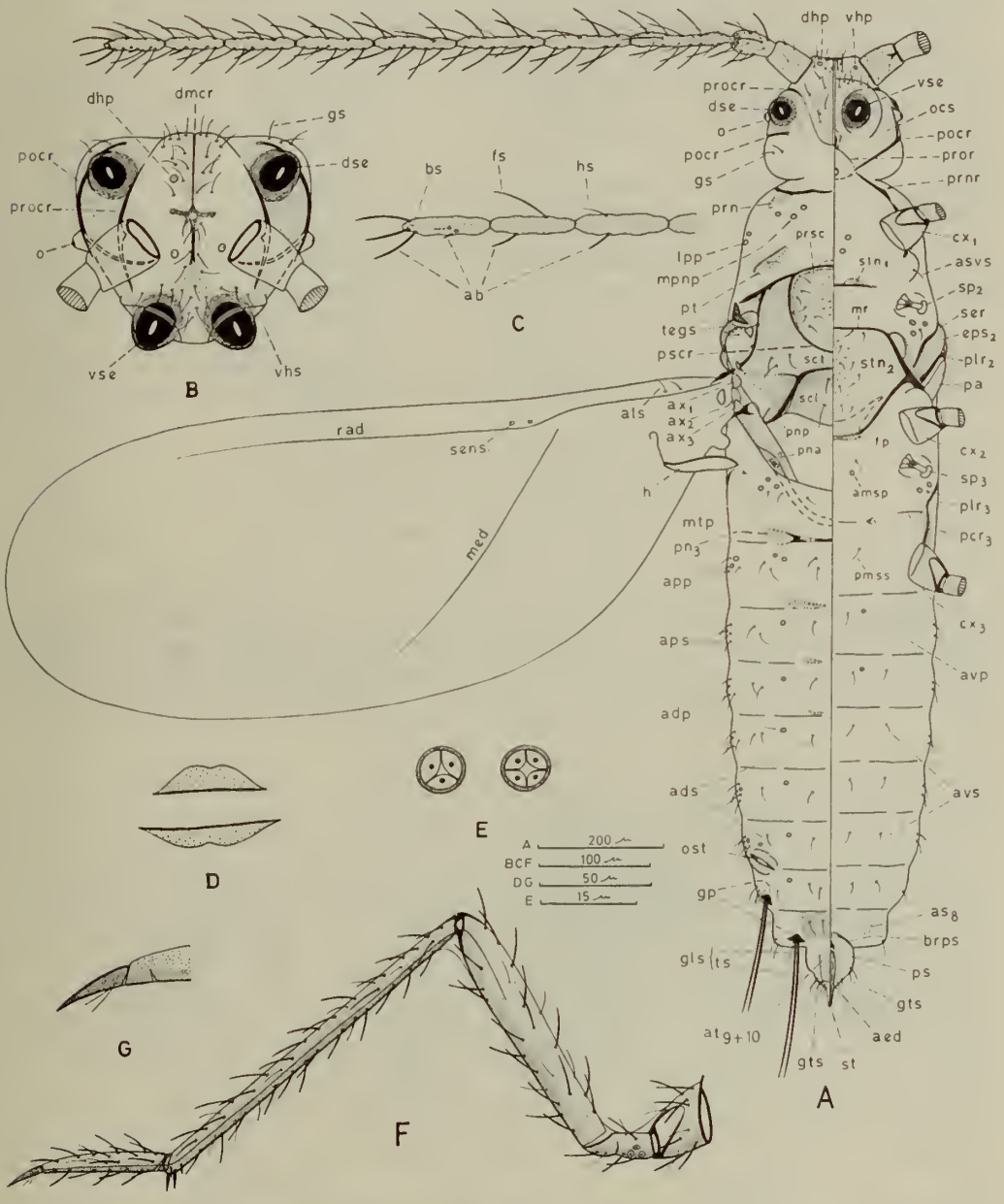


FIG. 35. *Centrococcus insolitus* (Green), dorsal and ventral view.

longest and those of middle and hind legs subequal in length ; the ratio width to length of the hind femur 1 : 6·5–7·5 (6·9). *Tibia* about 21μ wide ; with 2 apical spurs and usually 2 smaller spines ; the fore leg the femur shorter than the tibia, the ratio their lengths being 1 : 1·3–1·4 (1·33). *Tarsus* about 18μ wide ; *tarsal digitules* entirely absent. *Claw* gradually tapering to a sharply pointed tip ; *ungual digitules* fine. The lengths of the leg segments (in microns) and the number of setae on each are given in the following table :

		Fore leg	Middle leg	Hind leg
Coxa	length	49–55 (52)	49–55 (52)	52–58 (55)
	f.s.	9–13 (11·6)	10–13 (12·5)	10–14 (12·7)
	h.s.	2–5 (3·8)	2–4 (3·1)	3–5 (4·2)
Trochanter	length	70–76 (73)	70–76 (73)	73–79 (76)
	f.s.	4–6 (4·8)	4–6 (4·5)	4–7 (4·5)
	h.s.	2–3 (2·4)	2–3 (2·6)	2–4 (2·7)
Femur	length	268–308 (287)	259–296 (275)	259–296 (275)
	f.s.	28–39 (33·4)	27–36 (31·2)	28–38 (32·6)
	h.s.	6–9 (7·1)	6–8 (6·9)	7–10 (7·8)
Tibia	length	351–421 (381)	351–415 (372)	387–451 (409)
	f.s.	47–56 (51·8)	43–53 (48·2)	48–62 (57·7)
	h.s.	6–8 (6·7)	6–10 (8·3)	8–12 (10·4)
Tarsus	length	113–131 (119)	113–134 (122)	128–150 (134)
	f.s.	23–27 (24·6)	23–29 (25·1)	27–35 (32·8)
	h.s.	6–8 (6·9)	6–9 (7·6)	7–11 (8·3)
Claw	length	37–43 (40)	37–43 (40)	37–43 (40)
Total length of leg		888–1025 (949)	878–1016 (933)	939–1074 (988)

Abdomen : 494–661 (555)μ long and 327–365 (342)μ wide. Tergites of segments I, II, III and sometimes IV small ; those of segments VIII and IX + X well sclerotized. Sternites of segment VIII ill-defined. *Ostioles* well developed, 37–43 (40)μ long at orifice. *Abdominal setae* on each side : *Dorsal setae* 3–4 on segment I, 2–3 on segments II to VI, 3–4 on segment VII, and 1–3 on segment VIII. *Pleural setae* 3–4 on segment I, 4–6 on segment II, 5–6 on

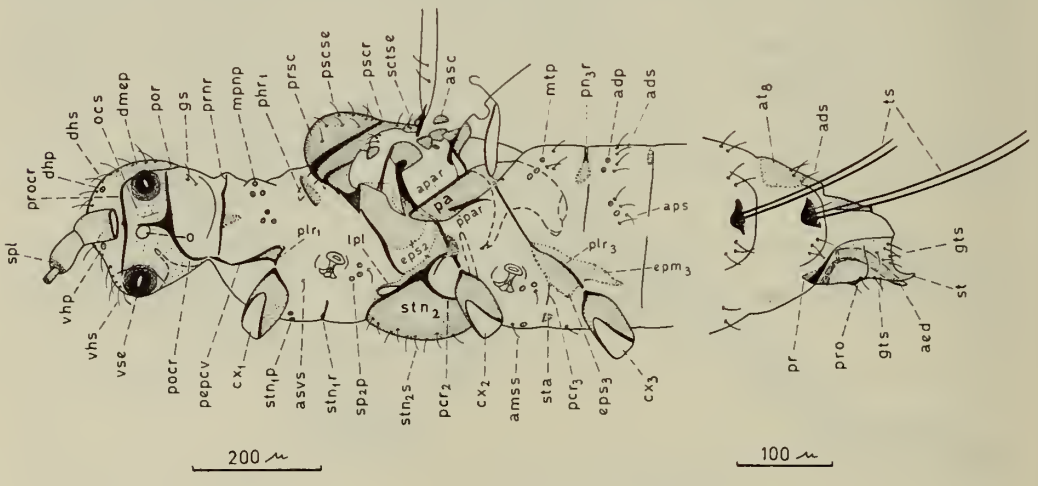


Fig. 36. *Centrococcus insolitus* (Green), lateral view.

segments III to VI, and 3–4 on segments VII and VIII. *Ventral setae* 1–2 on segment II, 2–3 on segment III, 2 on segments IV to VII, and absent on segment VIII. *Abdominal pores : Pleural pores* 2–3 (2·4) on segment I, 0–1 (0·2) on segment IV, 1–2 (1·3) on segment VI, and absent on other segments. *Dorsal pores* 1–3 (1·9), 1–2 (1·2), 1–2 (1·1), 0–2 (0·9), 0–1 (0·7), 0–2 (0·8), and 0–1 (0·7) on segments I to VII respectively. *Ventral pores* also sometimes present, 0–2 (0·7), 0–1 (0·3), and 0–1 (0·2) on segments III, IV and V respectively.

Glandular pouches occur on each side of segments VII and VIII. *Setae of the glandular pouch* of segment VII include a pair of 168–204 (183)μ long *tail setae* only ; those of segment VIII include a pair of 198–229 (214)μ long tail setae and a short one, subequal to the abdominal setae in length, i.e. the ratio length of the tail setae of segment VIII to the total body length 1 : 5·6–7·1 (6·5).

Genital segment comparatively small ; *style* rather straight in lateral view, with a rounded apex. *Penial sheath* 107–116 (113)μ long and 73–82 (76)μ wide, the ratio length to width being 1·3–1·6 (1·5) : 1, and the ratio its length to the total body length 1 : 11·8–13·4 (12·3). *Basal ridge of penial sheath* slender and its *projection* small. *Process of penial sheath* hardly pronounced. *Aedeagus* comparatively stout. *Setae of genital segment* on each side : *Dorsal setae* 5–7 (6·4) near the base of the style ; *ventral setae* 2–4 (2·8) on the penial sheath.

Material : 10 specimens examined, collected by H. K. Patel, on *Cajanus indicus*, in India (Anand), 14.xii.1955 (received from Dr. D. J. Williams).

NAIROBIA Group

NAIROBIA De Lotto, 1964

Nairobia bifrons De Lotto

(Text-figs. 37, 38)

Winged forms only known ; narrow and slender, comparatively large, with moderately long antennae and legs. The mounted males 1260–1596 (1442)μ long, 308–350 (336)μ wide at mesothorax and 2814–3528 (3248)μ wing expanse.

Body setae and *pores :* Fleshy setae entirely absent. Hair-like setae present on the antennae, legs and body, about 21μ long. Disc pores absent altogether.

Head : Subtetrahedron ; subtriangular in dorsal and front views ; *ventral preocular depression* hardly indicated in lateral view. Length from apex to postoccipital ridge 128–140 (131)μ ; from apex to neck 177–195 (186)μ ; width across the genae 220–241 (232)μ. *Dorsal arm of midcranial ridge* marked by a narrow sclerotization ; this sclerotization continuous with those indicating the *lateral* and the *ventral arms* anteriorly, and almost meeting the postocular ridge posteriorly. *Postoccipital ridge* confluent with preocular ridges. *Preocular ridge* well developed and completely separated from *postocular ridge ; interocular ridge* absent ; *preoral ridge* slender. *Eyes : Dorsal simple eyes* projecting beyond the outer margins of the head in dorsal view ; their corneae 18–24 (21)μ in diameter and separated by 125–162 (146)μ, i.e. 5·5–7·6 (6·9) times their diameter apart. *Ventral simple eyes* 21–24 (23)μ in diameter and 34–55 (46)μ apart. *Lateral ocelli* vestigial. *Ocular sclerites* large. *Cranial apophysis* truncate ; *tentorial bridge* slender. *Dorsal head setae* on each side : Setae in front of the postoccipital ridge in two separable groups, 3–5 (4·1) anteriorly and 4–6 (4·4) posteriorly ; each gena usually with 2 *genal setae* but 1 or 3 setae may occur on one side (av. 2·1). *Ventral head setae* on each side : One seta may occur between the ventral eyes (av. 0·4) ; 8–11 (8·8) forming on both sides a transverse band in the area of the ventral preocular depression ; 2–3 (2·2) in a longitudinal row anteriorly.

Antennae : Filiform ; normally 10-segmented but fusion between two or more adjacent flagellar segments on one or both antennae very common ; 799–933 (894)μ long, i.e. much

longer than half the body length, the ratio 1 : 1·4–1·7 (1·6), and subequal in length to the hind legs, the ratio 1·0–1·1 (1·08) : 1. *Scape* 58–64 (61)μ long and 52–58 (55)μ wide at base ; always with 4 h.s. *Pedicel* 76–85 (79)μ long and 43–46 (45)μ wide ; with 10–13 (11·6) h.s. and a *sensillum placodeum*. *Flagellum :* Flagellar segments cylindrical and 21–24μ wide ; segment III approximately as long as segment X, both being usually longest, the ratio their lengths 0·9–1·1 (1·06) : 1, and the ratio width to length of segments III and IX 1 : 3·4–4·2 (3·9) and 1 : 3·5–4·0 (3·7) respectively. Apart from the hair-like setae, the flagellar segments also with numerous apically knobbed, *capitate sensory setae*. The lengths of the flagellar segments and the number of setae on each are given below :

	III	IV	V	VI	VII	VIII	IX	X
length in μ	89–116	73–104	89–107	95–116	85–107	79–95	79–92	85–98
(av.)	(98)	(92)	(95)	(107)	(101)	(89)	(85)	(92)
h.s.	6–9	3–6	1–3	3–4	2–4	1–3	1–2	1–2
(av.)	(7·3)	(4·4)	(1·9)	(3·7)	(2·7)	(1·7)	(1·1)	(1·6)
set. ca.	2–5	2–5	7–11	8–13	7–12	6–12	7–15	9–13
(av.)	(3·6)	(4·3)	(8·7)	(11·1)	(10·2)	(9·4)	(11·1)	(10·9)

Antennal bristles well defined ; segments VIII and IX each with one ventral bristle. Segment X with 3 preapical bristles, the dorsal of which is slightly shorter ; terminal segment also with one apical hair-like seta.

Thorax : 502–578 (540)μ long. *Prothorax : Pronotal ridges* medially interrupted as usual ; *lateral pronotal sclerites* and *post-tergites* well defined. *Proepisternum* with a ridge-like dorsal margin. *Prosternum* very short, triangular, 12–18 (15)μ long ; *prosternal ridge* 101–113 (107)μ long. *Prothoracic setae : Medial pronotal, lateral pronotal* and *post-tergital setae* absent. *Antespiracular dorsal setae* 2–4 (3·1) ; *antespiracular ventral seta* always 1 ; *prosternal setae* 2–3 (2·4).

Mesothorax : Prescutum triangular in dorsal view ; 95–113 (107)μ long and 116–128 (125)μ wide, the ratio being 1 : 1·1–1·3 (1·2). *Prescutal ridge* well developed and *prescutal suture* distinct. *Scutum* comparatively short and evenly sclerotized ; 55–67 (61)μ long, i.e. the ratio lengths of prescutum to scutum 1·6–2·1 (1·8) : 1. *Prealare, prealar ridge, triangular plate, tegula, anterior* and *posterior notal wing processes* well developed. *Scutellum* 82–98 (92)μ long and 107–119 (113)μ wide, ratio 1 : 1·2–1·3 (1·23), and the ratio its length to the length of scutum 1·4–1·7 (1·5) : 1. *Postalare* with well separated *anterior* and *posterior postalar ridges*. *Mesopleuron : Mesopleural ridge* interrupted above the coxal articulation ; *basalare* slender. *Mesepisternum* and *mesepimeron* well defined ; *lateropleurite* moderately large, with a distinct oval membranous area. *Mesosternum : Basisternum* 153–168 (162)μ long and 198–232 (223)μ wide ; *marginal, precoxal ridges* and *furca* well developed. *Mesothoracic spiracle* 24–27 (26)μ wide at opening, with a 43–49 (46)μ long supporting bar. *Mesothoracic setae* on each side : *Prescutal setae* 1–2 (1·7) ; *scutal setae* 1–3 (1·8) ; *scutellar setae* usually 1 and occasionally 2 (1·1). *Tegular setae* 3–4 (3·7). *Postmesostigmatal setae* absent. *Basisternal setae* (stn25) 2–4 (3·6).

Metathorax : Metapostnotal sclerites distinct but the *metapostnotal ridge* absent. *Metapleural ridge* with the usual attenuation near the middle. *Precoxal ridge* weakly developed ; *metasternal apophysis* distinct. *Metathoracic spiracle* similar to the mesothoracic. *Metathoracic setae* on each side : *Metatergal setae* always 2 ; *metapleural setae* usually 1–2 but sometimes missing on one side (av. 0·8). *Anterior* and *posterior metasternal setae* 1–2 (averages 1·3 and 1·1 respectively).

Wings : 1260–1610 (1470)μ long and 420–532 (490)μ wide ; *alar setae* absent and *circular sensoria* could not be detected and presumably also absent. *Hamulohalterae* 110–125 (119)μ long and 24–31 (28)μ wide ; with one apically hooked seta, 40–49 (46)μ long, the ratio lengths of seta to the hamulohaltera being 1 : 2·4–3·0 (2·6).

Legs : Moderately long ; fore legs shortest and hind legs longest ; the ratio length of the hind leg to the total body length 1 : 1·5–2·0 (1·8). *Coxa* and *trochanter* about 55 and 31μ wide. *Femur* about 40μ wide ; that of the fore leg shortest and that of the hind leg longest ; the ratio width to length of the hind femur 1 : 5·4–6·2 (5·8). *Tibia* about 21μ wide ; with 2 apical spurs ; in front leg, the femur slightly shorter than the tibia, the ratio their lengths being

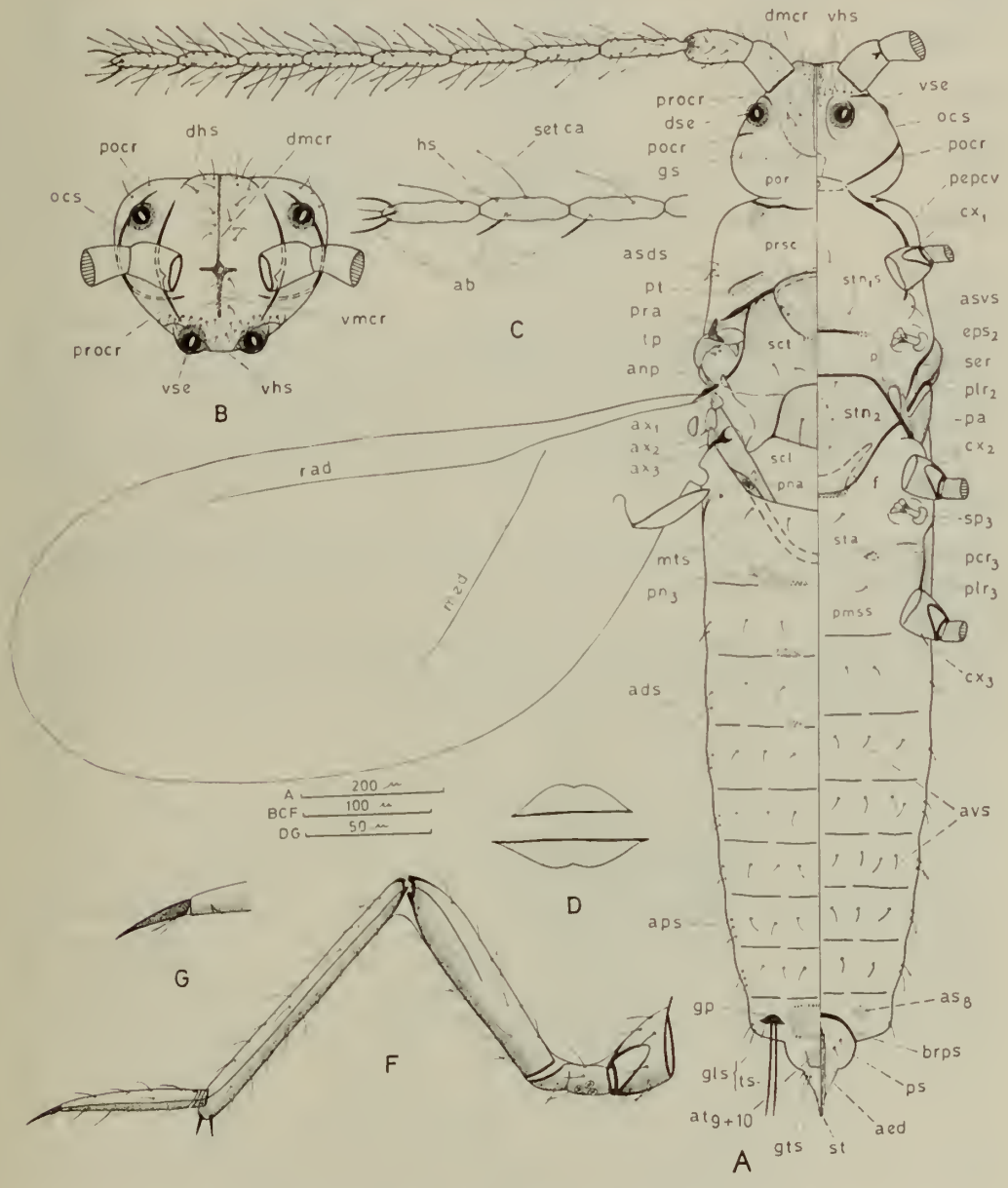


Fig. 37. *Nairobia bifrons* De Lotto, dorsal and ventral view.

1 : 1·1–1·2 (1·17). *Tarsus* about 18μ wide ; *tarsal digitules* absent. *Claw* gradually tapering to a sharply pointed tip ; *ungual digitules* fine. The lengths of the leg segments (in microns) and the number of setae on each are given in the following table :

		Fore leg	Middle leg	Hind leg
Coxa	length	49–55 52)	49–55 (52)	52–58 (55)
	h.s.	6–9 (7·1)	6–10 (7·9)	8–11 (9·4)
Trochanter	length	64–73 (69)	64–73 (69)	67–76 (73)
	h.s.	4–6 (5·2)	4–6 (5·0)	4–7 (5·6)
Femur	length	207–241 (226)	214–244 (229)	214–247 (232)
	h.s.	15–23 (19·2)	18–25 (20·6)	16–24 (19·8)
Tibia	length	244–281 (265)	250–293 (278)	268–311 (296)
	h.s.	16–22 (19·8)	17–26 (21·4)	19–30 (26·2)
Tarsus	length	107–122 (116)	107–122 (119)	113–128 (122)
	h.s.	11–15 (13·3)	11–14 (12·8)	12–16 (14·5)
Claw	length	31–37 (34)	31–37 (34)	31–37 (34)
Total length of leg		702–796 (744)	720–821 (784)	747–857 (814)

Abdomen : 464–707 (623)μ long and 319–365 (350)μ wide. Tergites of segments I and II small; those of segments VIII and IX + X well defined. Sternites of segment VIII small. *Ostioles* entirely absent. *Abdominal setae* on each side : *Dorsal setae* 2 on segment I, 2–3 on segments II to VII, and absent on segment VIII. *Pleural setae* 2 on segment I, 2–3 on segment II, 3–4 on segments III to V, 3–5 on segments VI and VII, and 2–3 on segment VIII. *Ventral setae* 2 on segment II, 3–5 on segments III to V, 2–3 on segments VI and VII, and absent on segment VIII.

Setae of *glandular pouch* include a pair of 122–153 (137)μ long *tail setae* and one seta about as long as the abdominal setae, i.e. the ratio length of tail setae to the total body length 1 : 8·2–11·9 (10·5).

Genital segment comparatively small ; *style* rather straight in lateral view, with a pointed apex. *Penial sheath* 134–146 (140)μ long and 92–98 (95)μ wide, the ratio being 1·4–1·6 (1·5) : 1, and the ratio its length to the total length of the body 1 : 9·2–11·5 (10·3). *Basal ridges of*

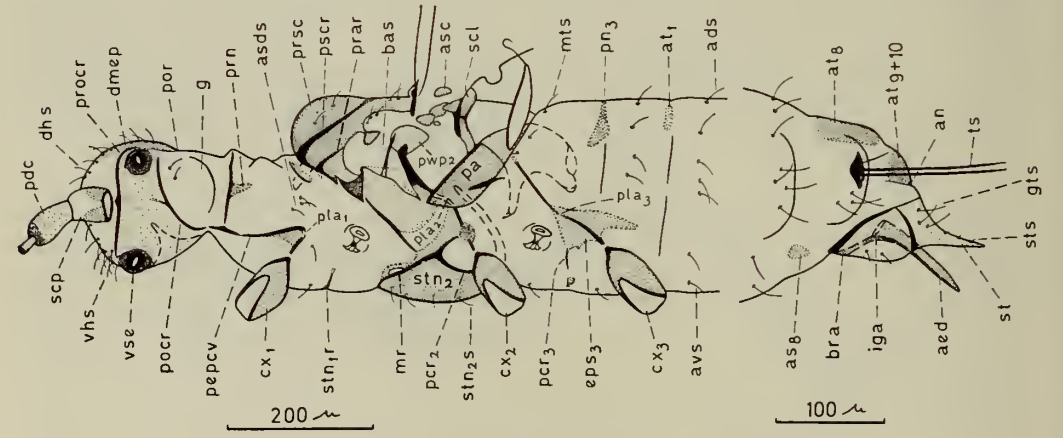


FIG. 38. *Nairobia bifrons* De Lotto, lateral view.

penial sheath medially continuous ; their *projections* as well as the *processes of penial sheath* absent. *Aedeagus* with a large *internal genital aperture*. *Setae of genital segment : Dorsally* 3 setae always present on each side near the base of the style ; *ventrally* 2–3 (2·1) smaller setae occur on each side of the penial sheath. *Style* also usually with 3 latero-dorsal minute *sensilla* on each side.

Material : 10 specimens examined, collected by G. De Lotto, on *Lonicera battiscombei* Hutch., in Nairobi, Kenya, 8.xi.1962.

ERIOCOCCIDAE

ERIOCOCCUS Targioni-Tozetti, 1868

Eriococcus araucariae Maskell

(Text-figs. 39, 40)

Macropterous forms only known ; living specimens light brown in colour. A moderately robust species, moderately large, with comparatively short antennae and moderately long legs. Mounted specimens 1078–1344 (1218)μ long, 308–364 (336)μ wide at mesothorax and 2016–2324 (2170)μ wing expanse.

Body setae : Antennae and legs with numerous, approximately 15μ long fleshy setae and slightly longer hair-like ones ; the body with hair-like setae only.

Head : Subtetrahedron ; subtriangular in dorsal view and more or less rounded in front view ; *ventral preocular depression* hardly indicated in lateral view. Length from apex to postoccipital ridge 420–518 (462)μ from apex to neck 756–826 (798)μ ; width across the genae 980–1106 (1036)μ. *Midcranial ridge* cruciform ; *dorsal arm* short, jointed to the *ventral* and the *lateral arms* at the apex of the head (Text-fig. 39,B). *Postoccipital ridge* strongly developed, with the lateral extremities sharply bent posteriorly and giving off a short sclerotization anteriorly. *Dorsomedial part of epicranium* narrow and slightly raised. *Preocular* and *postocular ridges* widely separated ; the latter ventrally articulates with a small *additional ridge ; preoral ridge* slender. *Eyes : Dorsal simple eyes* projecting well beyond the outer margins of the head in dorsal view ; their corneae 34–40 (38)μ in diameter and separated by 110–125 (116)μ, i.e. 2·9–3·4 (3·2) times their diameter apart. *Ventral simple eyes* 27–34 (31)μ in diameter and 21–24 (23)μ apart. *Lateral ocelli* anteriorly attached to the postocular ridges. *Ocular sclerites* weakly sclerotized. *Cranial apophysis* apically bifurcate. *Anterior tentorial arms* join the cranial apophysis separately ; *tentorial bridge* comparatively stout. *Dorsal head setae* 8–11 (9·1) on each side ; each gena with 3–6 (4·3) *genal setae*. *Ventral head setae* on each side : Setae between the ventral eyes absent ; 14–22 (17·8) forming on both sides a transverse band in the area of the ventral preocular depression ; 3–5 (4·1) longitudinally arranged anteriorly. A peculiar organ of obscure homology (X) always present on each side of the dorsal arm of the midcranial ridge near the apex of the head.

Antennae : Rather filiform ; normally 10-segmented, with occasional fusion between two adjacent segments of the flagellum ; 516–622 (564)μ long, i.e. as long as or slightly shorter than half the total length of the body, the ratio being 1 : 2·0–2·3 (2·2), and nearly as long as the hind legs, the ratio 1 : 1·0–1·2 (1·1). *Scape* 40–46 (42)μ long and 37–43 (40)μ wide at base ; with 4–5 (4·3) h.s. *Pedicel* 61–70 (67)μ long and 34–40 (37)μ wide ; with 13–24 (16·8) f.s., 20–28 (26·0) h.s. and a *sensillum placodeum*. *Flagellum :* Flagellar segments about 24μ wide, with the preterminal segments somewhat wider. Segment III club-shaped and longest of all, the ratio its length to the length of segment X 1·4–1·7 (1·5) : 1, and the ratio its width to its length 1 : 3·4–4·0 (3·8). Segments IV to IX barrel-shaped, the ratio width to length

of segment IX being 1 : 1·4–1·9 (1·7) ; terminal segment pear-shaped. Segments V or VI to X always with a few apically knobbed *capitate sensory setae*. The following table shows the lengths of the flagellar segments and the number of setae on each :

	III	IV	V	VI	VII	VIII	IX	X
Length in μ	82–98	55–73	49–58	49–55	43–52	40–49	40–46	52–61
(av.)	(89)	(64)	(55)	(52)	(49)	(45)	(45)	(58)
f.s.	14–19	11–22	12–19	13–18	12–20	10–17	6–10	1–4
(av.)	(17·0)	(16·7)	(15·4)	(15·7)	(14·5)	(12·7)	(8·1)	(2·7)
h.s.	9–12	7–10	7–10	7–10	6–11	6–10	4–10	5–8
(av.)	(10·7)	(8·7)	(8·4)	(9·1)	(9·2)	(8·1)	(7·1)	(6·3)
Setc. ca.	0	0	0–2	1–3	1–4	2–4	2–5	3–6
(av.)	0	0	(0·9)	(1·5)	(2·1)	(2·5)	(3·0)	(4·1)

Antennal bristles stouter and longer than the fleshy setae ; segments VIII and IX each with a ventral bristle. Terminal segment with 3 bristles, the dorsal of which slightly shorter and nearer to the apex ; the segment also with a lateral pair of much smaller bristles and one apical hair-like seta. Jancke (1955) recorded 2 bristles only occurring on the terminal segment.

Thorax : 517–585 (547)μ long. *Prothorax :* Comparatively short ; *pronotal ridges* medially interrupted at a weakly sclerotized point ; *lateral pronotal sclerites* and *post-tergites* ill-defined. *Proepisternum* without any ridge-like sclerotization ; *propleural ridge* short and *propleural apophysis* small. *Prosternum* triangular, 58–76 (67)μ long ; *prosternal ridge* 92–107 (101)μ long, with a small, crescent-like extension antero-medially. *Prothoracic setae : Medial pronotal setae* usually absent although one seta was found in one specimen ; *lateral pronotal, post-tergital* and *antespiracular dorsal setae* absent. *Antespiracular ventral setae* always one on each side ; *prosternal setae* 0–1 (0·8).

Mesothorax : Prescutum 70–79 (76)μ long and 131–156 (143)μ wide (ratio 1 : 1·8–2·0, av. 1·9) ; laterally and posteriorly bounded by the *prescutal ridges* and the *prescutal suture* respectively. *Scutum* short and evenly sclerotized ; 40–49 (43)μ long, i.e. the ratio lengths of prescutum to scutum 1·6–1·9 (1·8) : 1. *Prealare, prealar ridge, triangular plate, tegula, anterior* and *posterior notal wing processes* well developed. *Scutellum* transverse, rectangular in dorsal view ; 52–61 (58)μ long and 113–140 (128)μ wide, i.e. the ratios its length to its width 1 : 2·0–2·3 (2·2), and its length to the length of scutum 1·3–1·5 (1·4) : 1 ; the scutellum obliquely transversed on each side by a well developed *scutellar ridge* dividing it into 3 triangular parts. *Anterior* and *posterior postalar ridges* anteriorly joined. *Postnotal apophysis* strong. *Mesopleuron : Mesopleural ridge* continuous above the coxal articulation ; *mesopleural apophysis* and *mesopleural wing process* well developed ; *basalare* slender. *Subepisternal ridge* distinct. *Mesepisternum* weakly sclerotized and *mesepimeron* small ; *lateropleurite* comparatively large. *Mesosternum : Basisternum* 125–156 (140)μ long and 168–214 (189)μ wide ; *marginal, precoxal ridges* and *furca* well developed. *Mesothoracic spiracle* 21–24 (22)μ wide at opening, with a 37–43 (40)μ long supporting bar. *Mesothoracic setae* on each side : *Prescutal setae* 1–2 (1·6) ; *scutal setae* 2–4 (2·9) ; *scutellar setae* 1–2 (1·1). *Tegular setae* 4–5 (4·2). *Postmesostigmatal* and *basisternal setae* absent.

Metathorax : Metapostnotal sclerites well defined ; *metapostnotal ridge* absent. *Metapleural ridge* attenuated towards the small *metapleural apophysis* and dorsally supporting a small *pleural wing process. Metepisternum* and *metepimeron* distinct. *Precoxal ridge* and *metasternal apophysis* well developed. *Metathoracic spiracle* identical with the mesothoracic. *Metathoracic setae* on each side : *Metatergal setae* always 3, one of which separated submedially ; *metapleural setae* absent ; *anterior metasternal setae* 0–2 (1·1) and *posterior metasternal setae* missing.

Wings : 868–994 (924)μ long and 378–434 (406)μ wide ; always with 2 *alar setae. Hamulohalterae* 67–76 (73)μ long and 18–21 (19)μ wide ; with one apically hooked, 67–79 (76)μ long seta, i.e. the ratio lengths of seta to hamulohaltera 1·0–1·1 (1·04) : 1.

Legs : Moderately long ; the fore and the middle legs subequal, and the hind legs longest ; the ratio length of the hind leg to the total body length 1 : 1·8–2·1 (2·0). *Coxa* about 46 and *trochanter* about 24μ wide. *Femur* about 37μ wide ; that of the fore leg usually longest and that of the middle leg shortest ; the ratio width to length of the hind femur 1 : 4·2–4·8 (4·6). *Tibia* about 21μ wide ; with 2 apical strong spurs and 2–4 smaller spines ; in fore leg the femur shorter than the tibia, the ratio their lengths being 1 : 1·29–1·33 (1·3). *Tarsus* about 18μ

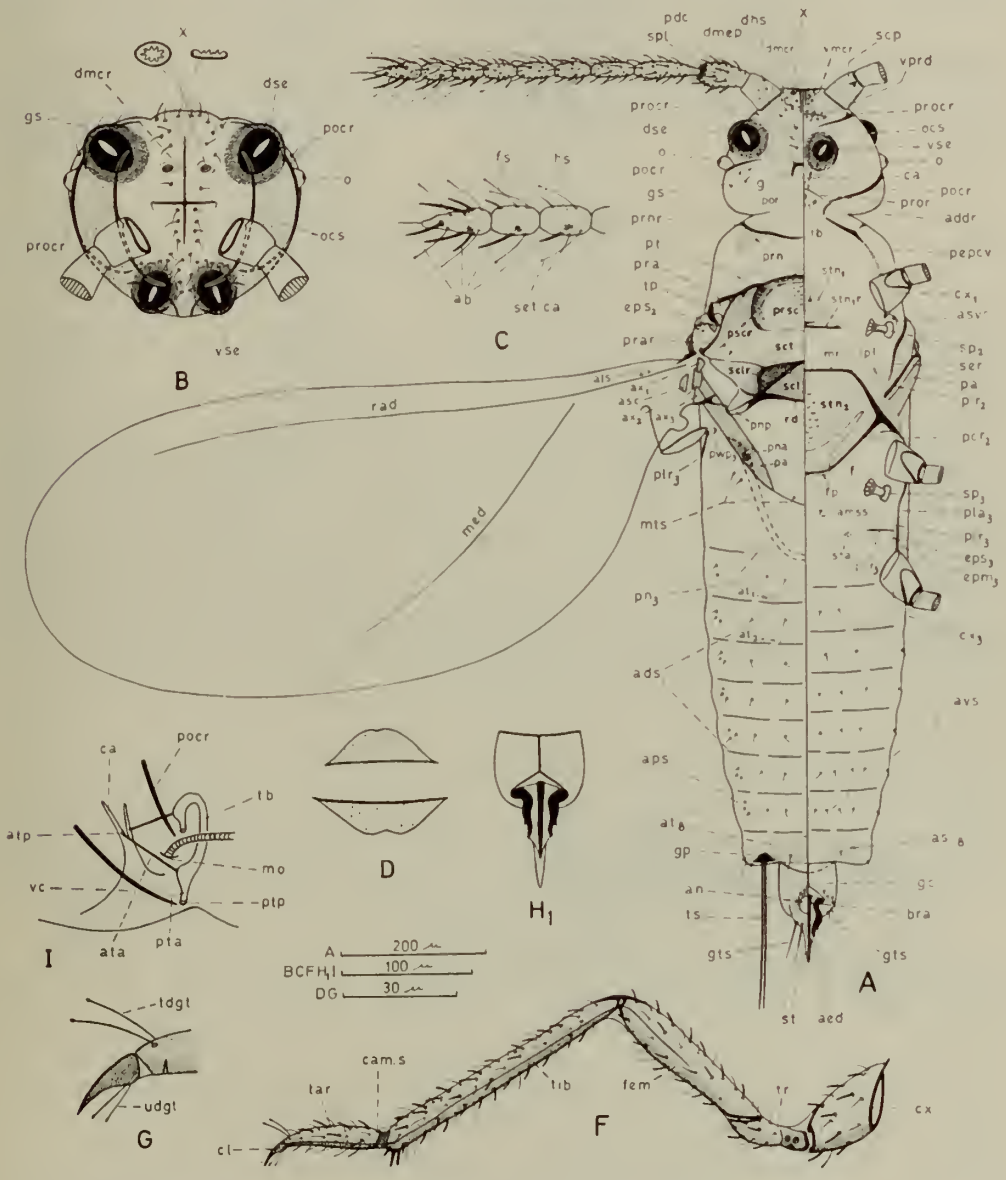


FIG. 39. *Eriococcus araucariae* Maskell, dorsal and ventral view.

wide ; *tarsal digitules* apically knobbed, 24–27 (26)μ long. *Claw* broad at base, abruptly tapering to a pointed tip ; with a pair of apically knobbed *ungual digitules*. The following table shows the length of the leg segments (in microns) and the number of setae on each:

		Fore leg	Middle leg	Hind leg
Coxa	length	40–43 (41)	40–46 (42)	46–49 (47)
	f.s.	8–12 (9·6)	9–16 (11·8)	11–19 (13·6)
	h.s.	10–15 (12·4)	11–14 (12·2)	10–13 (11·8)
Trochanter	length	58–64 (61)	61–70 (65)	64–73 (70)
	f.s.	3–5 (4·2)	4–8 (6·1)	5–9 (6·8)
	h.s.	6–9 (8·8)	6–11 (8·2)	6–11 (8·0)
Femur	length	159–183 (168)	137–165 (150)	153–177 (162)
	f.s.	22–31 (26·2)	19–28 (24·6)	23–29 (25·9)
	h.s.	29–39 (35·1)	26–31 (29·0)	26–33 (30·2)
Tibia	length	207–244 (217)	214–250 (229)	226–256 (238)
	f.s.	35–49 (44·0)	40–52 (48·2)	42–55 (49·6)
	h.s.	42–61 (52·6)	44–63 (55·2)	46–67 (57·4)
Tarsus	length	73–82 (76)	79–85 (82)	79–92 (83)
	f.s.	10–13 (11·8)	10–13 (11·4)	10–14 (11·2)
	h.s.	16–27 (22·2)	17–27 (22·4)	22–28 (24·4)
Claw	length	15–18 (17)	15–18 (17)	15–18 (17)
Total length of leg		549–631 (573)	546–634 (593)	586–653 (619)

Abdomen : 327–479 (410)μ long and 281–334 (312)μ wide. Tergites of segments I and II small ; that of segment VIII large. *Sternites* of segment VIII ill-defined. *Ostioles* absent. *Abdominal setae* on each side : *Dorsal setae* 2–3 on segment I, 2 on segments II to VII, and one slightly longer seta on segment VIII. *Pleural setae* 2 on segment I, 3–4 on segments II to VI, and 4–5 on segments VII and VIII, including one slightly longer seta on the latter. *Ventral setae* 2–3 on segments II to IV, 3–4 on segments V to VII, and 1–2 on segment VIII.

Glandular pouches small ; *setae of glandular pouch* include a pair of 198–217 (207)μ long *tail setae*, the ratio their length to the total length of the body being 1 : 5·4–6·3 (5·9).

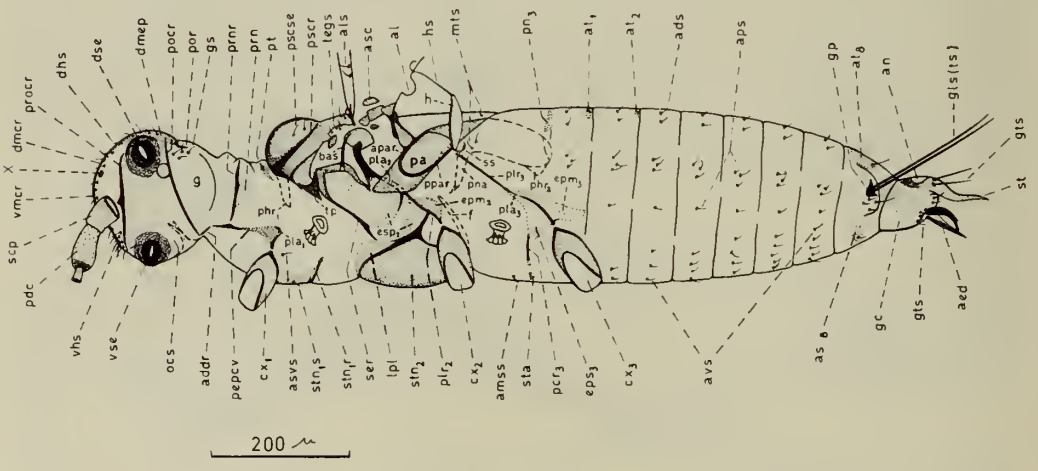


Fig. 40. *Eriococcus araucariae* Maskell, lateral view.

Genital segment : Genital capsule 137–156 (143)μ long and 73–79 (76)μ wide, i.e. the ratio its length to its width 1·8–2·0 (1·9) : 1, and its length to total body length 1 : 7·9–8·9 (8·5) ; *style* undulating in lateral view. *Anal opening* 18–21 (20)μ in diameter. Ventrally, a median, longitudinal slender ridge present, giving off two lateral branches extending towards the base of the aedeagus. *Aedeagus* strongly developed and ventrally sclerotized ; also with latero-ventral heavy sclerotizations and a pair of small processes on each side. *Setae of genital segment : Dorsally* two setae, about 61μ long always present on each side near the base of the style ; *ventrally* 5–6 (5·2) setae occur on each side of the genital capsule.

Material : 10 specimens examined, collected by myself on *Araucaria excelsa*, in Alexandria, Egypt, U.A.R., during the last week of June and the first week of July, 1961.

Eriococcus orariensis Hoy

(Text-figs. 41, 42)

Winged forms only known ; living specimens not available. The males moderately robust, comparatively small, with short antennae and short legs. Mounted specimens 812–938 (882)μ long, 224–266 (250)μ wide at mesothorax and 1652–1848 (1736)μ wing expanse.

Body setae : Antennae and legs with fleshy and hair-like setae, about 12 and 18μ long respectively ; the body itself with slightly smaller hair-like setae only.

Head : Subtetrahedron ; subtriangular in dorsal view and rather rounded in front view ; *ventral preocular depression* hardly indicated in lateral view. Length from apex to post-occipital ridge 70–85 (76)μ ; from apex to neck 116–125 (122)μ ; width across the genae 156–165 (159)μ. *Dorsal arm* of midcranial ridge short, joined to the *lateral* and the *ventral arms* at the apex of the head. *Postoccipital ridge* strongly developed, with the lateral extremities bending posteriorly and giving off a short heavy sclerotization anteriorly. *Dorsomedial part of epicranium* narrow. *Preocular* and *postocular ridges* widely separated ; the latter ventrally articulates with a small *additional ridge*. *Preoral ridge* slender. *Eyes : Dorsal simple eyes* slightly projecting beyond the lateral margins of the head ; their corneae 15–18 (16)μ in diameter and separated by 85–96 (89)μ, i.e. 4·7–6·0 (5·4) times their diameter apart. *Ventral simple eyes* subequal in diameter and 18–24 (21)μ apart. *Lateral ocelli* anteriorly attached to postocular ridges. *Ocular sclerites* large. *Cranial apophysis* apically bifurcate. *Tentorial bridge* stout. *Dorsal head setae* 8–10 (9·8) on each side ; each gena with 2–3 (2·7) *genal setae*. *Ventral head setae* on each side : 3–5 (4·1) in the area of the ventral preocular depression, forming on both sides a transverse band ; anteriorly a row of 2–3 (2·7) h.s. present on each side of the ventral arm of the midcranial ridge.

Antennae : Rather moniliform ; normally 10-segmented ; 329–354 (339)μ long, i.e. shorter than half the total length of the body, the ratio being 1 : 2·4–2·8), and about as long as the hind legs, the ratio 1 : 1·1–1·2 (1·15). *Scape* 31–34 (32)μ long and 34μ wide at base ; always with 4 h.s. *Pedicel* 43–46 (45)μ long and 27–31 (28)μ wide ; with 4–10 (6·6 f.s., 8–13 (11·3) h.s. and a *sensillum placodeum*. *Flagellum :* Flagellar segments 18–21μ wide, with the pre-terminal segments becoming slightly wider. Segment III club-shaped and longest of all, the ratio its length to the length of the terminal segment 1·40–1·54 (1·5) : 1, and the ratio its width to its length 1 : 2·9–3·3 (3·2). Segments IV to IX barrel-shaped, the ratio width to length of segment IX being 1 : 1·0–1·4 (1·2) ; terminal segment pear-shaped. Segments VIII, IX, X and sometimes VII carry a number of apically knobbed *capitate sensory setae*. In the following table the lengths of the flagellar segments and the number of setae on each are given :

	III	IV	V	VI	VII	VIII	IX	X
length in μ	58–61	27–31	24–31	21–27	24–31	24–31	24–31	40
(av.)	(60)	(29)	(27)	(24)	(27)	(27)	(27)	(40)
f.s.	6–10	2–5	3–8	4–8	3–8	3–6	2–5	2–3
(av.)	(7·7)	(3·1)	(6·0)	(5·8)	(5·8)	(3·9)	(3·3)	(2·1)
h.s.	3–6	3–5	3–5	2–4	3–7	3–8	5–8	2–5
(av.)	(4·8)	(3·3)	(4·1)	(3·2)	(5·2)	(5·6)	(6·1)	(3·3)
Set. ca.	0	0	0	0	0–1	1–2	2–3	5–7
(av.)	0	0	0	0	(0·2)	(1·3)	(2·3)	(5·6)

Antennal bristles well defined ; segments VIII and IX each with one ventral bristle. Terminal segment with 3 slightly longer bristles, the dorsal of which nearer to the apex, and one apical hair-like seta.

Thorax : 350–403 (388)μ long. *Prothorax : Pronotal ridges* with the usual weak interruption at the middle ; *lateral pronotal sclerite* and *post-tergites* small. *Proepisternum* without any ridge-like sclerotization. *Prosternum* triangular, 18–31 (24)μ long ; *prosternal ridge* with a small crescent-like antero-median extension, 67–79 (73)μ long. *Prothoracic setae : Medial, lateral pronotal, post-tergital* and *antespiracular dorsal setae* absent. One *antespiracular ventral seta* may be present (av. 0·4), and one *prosternal seta* always present on each side of the median line.

Mesothorax : Prescutum 49–58 (55)μ long and 79–89 (85)μ wide, the ratio being 1 : 1·4–1·7 (1·6) ; *prescutal ridge* well developed and *prescutal suture* distinct. *Scutum* 46–52 (49)μ long, i.e. the ratio lengths of prescutum to scutum 1·0–1·3 (1·1) : 1. *Prealare, prealar ridge, tegula, anterior* and *posterior notal wing processes* well developed. *Scutellum* 31–34 (33)μ long and 73–82 (79)μ wide, i.e. the ratio 1 : 2·3–2·7 (2·4), and its length to the length of the scutum 1 : 1·4–1·6 (1·5) ; *scutellar ridge* distinct. *Postalare* with the *anterior* and *posterior postalar ridges* joined. *Mesopleuron : Mesopleural ridge* continuous above the coxal articulation ; *mesopleural apophysis, mesopleural wing process* and *subepisternal ridge* well developed ; *basalare* slender. *Mesepisternum* and *mesepimeron* well defined ; *lateropleurite* comparatively large. *Mesosternum : Basisternum* 85–98 (92)μ long and 134–159 (150)μ wide ; bounded by the *marginal* and the *precoxal ridges*. *Furca* well developed. *Mesothoracic spiracle* 12–15 (14)μ wide at opening, with a 27–31 (29)μ long supporting bar. *Mesothoracic setae* on each side : *Prescutal setae* 1–2 (1·5) ; *scutal setae* 2–3 (2·2) ; *scutellar seta* always one. *Tegular setae* 2–3 (2·6). Each lateropleurite always with a small *lateropleurital seta*. *Postmesostigmatal* and *basisternal setae* absent. *Metathorax : Metapostnotal sclerite* small ; *metapostnotal ridge* absent. *Metapleural ridge* attenuated towards the small *metapleural apophysis*. *Metepisternum* and *metepimeron* distinct. *Precoxal ridge* and *metasternal apophysis* well developed. *Metathoracic spiracles* similar to the mesothoracic. *Metathoracic setae* on each side : *Metatergal setae* 1–2 (1·7) ; *metapleural setae* absent ; one *anterior metasternal seta* always present, and *posterior metasternal setae* absent.

Wings : 714–798 (756)μ long and 266–308 (280)μ wide ; with one *alar seta*. *Hamulohalterae* 49–58 (52)μ long and 15–18 (17)μ wide ; with one apically hooked, 49–67 (61)μ long seta, i.e. the ratio lengths of seta to hamulohaltera 1 : 0·9–1·1 (1·0).

Legs : Comparatively short and stout ; the fore and middle legs of subequal length and shorter than the hind leg ; the ratio length of the hind leg to the total body length 1 : 2·1–2·4 (2·3). *Coxa* and *trochanter* about 37 and 21μ wide respectively. *Femur* about 31μ wide ; that of the middle leg shortest, and those of the fore and hind legs subequal ; the ratio width to length of the hind femur 1 : 3·4–3·8 (3·6). *Tibia* about 18μ wide ; with 2 apical spurs and 2–3 smaller spines ; in the fore leg the femur shorter than the tibia, the ratio their lengths being 1 : 1·1–1·3 (1·2). *Tarsus* about 15μ wide ; *tarsal digitules* apically knobbed, about 27μ long. *Claw* broad at base and abruptly tapering towards a pointed tip ; *ungual digitules*

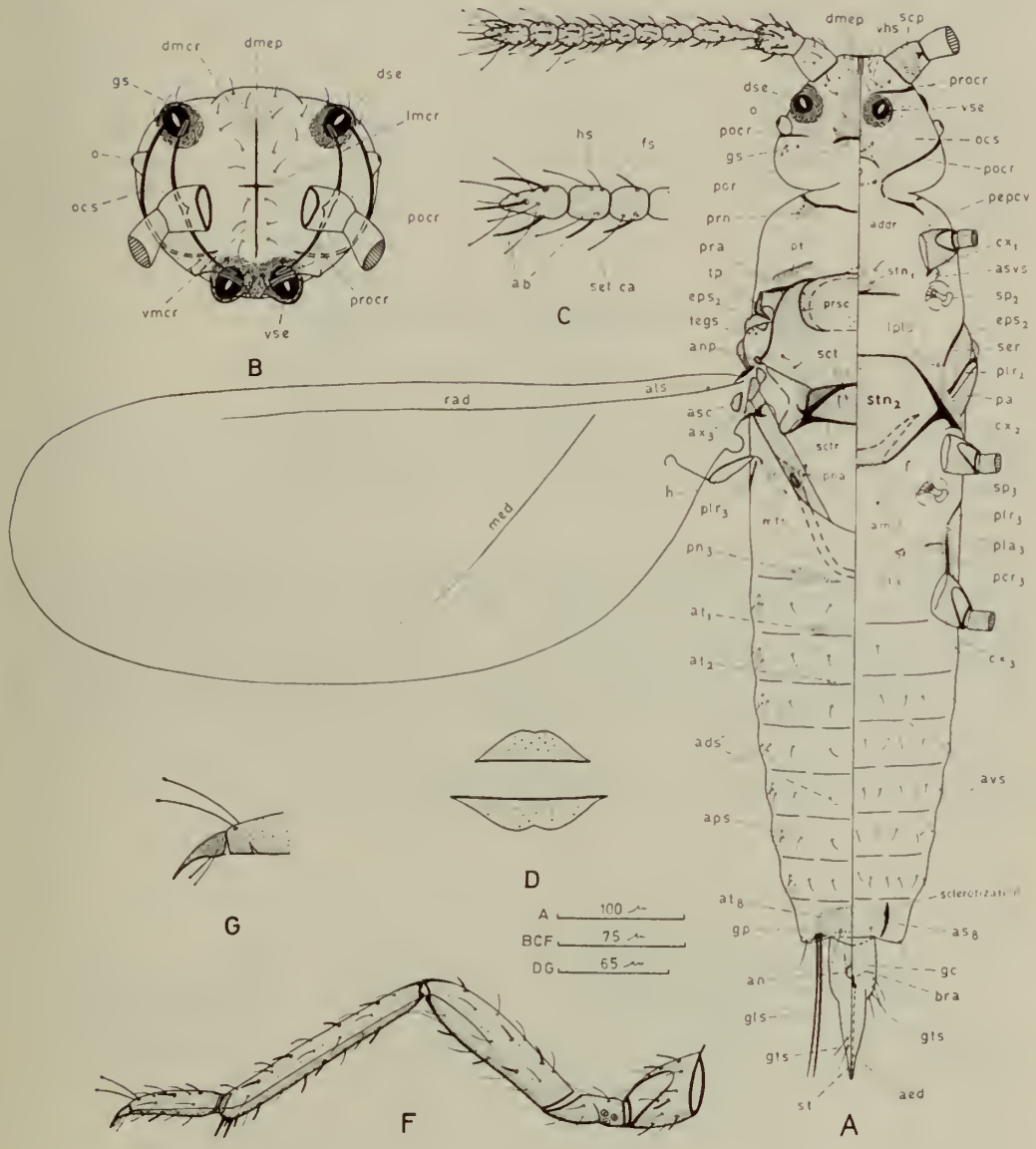


FIG. 41. *Eriococcus orariensis* Hoy, dorsal and ventral view.

apically knobbed. The lengths of the leg segments (in microns) and the number of setae on each are given in the following table :

		Fore leg	Middle leg	Hind leg
Coxa	length	27–31 (29)	27–31 (29)	31–34 (32)
	f.s.	1–3 (2·1)	1–5 (2·9)	1–5 (3·1)
	h.s.	6–10 (7·5)	5–8 (6·4)	5–8 (6·2)
Trochanter	length	40–46 (43)	43–49 (46)	46–49 (48)
	f.s.	0–1 (0·1)	0–1 (0·1)	0–1 (0·2)
	h.s.	3–6 (3·9)	3–6 (4·3)	4–5 (4·5)
Femur	length	104–110 (107)	92–104 (98)	104–116 (110)
	f.s.	6–10 (7·8)	5–10 (8·1)	4–9 (6·2)
	h.s.	13–19 (15·8)	11–15 (13·5)	10–14 (11·8)
Tibia	length	116–137 (128)	116–137 (128)	137–153 (143)
	f.s.	6–9 (7·9)	7–10 (8·2)	7–13 (9·1)
	h.s.	15–22 (18·8)	14–24 (20·4)	18–25 (21·3)
Tarsus	length	49–52 (50)	49–52 (50)	49–55 (52)
	f.s.	3–5 (3·5)	2–5 (3·4)	2–5 (3·5)
	h.s.	10–13 (11·6)	10–14 (12·1)	10–14 (11·8)
Claw	length	12–15 (14)	12–15 (14)	12–15 (14)
Total length of leg		348–384 (366)	342–384 (363)	384–421 (394)

Abdomen : 228–319 (281)μ long and 205–220 (213)μ wide. Tergites of segments I and II small ; that of segment VIII large. Sternites of segment VIII bounded along their outer margins by a longitudinal heavily sclerotized strip. *Ostioles* absent. *Abdominal setae* on each side : *Dorsal setae* usually 2 on segments I to VII (sometimes 3 on segments IV and VI), and one slightly longer seta on segment VIII. *Pleural setae* 2 on segment I, 2–3 on segment II, and 3 on segments III to VIII, including a longer one on the latter segment. *Ventral setae* 1 on segment II, 2–3 on segment III, 4–5 on segments IV to VII, and 1 on segment VIII.

Glandular pouches small ; *setae of glandular pouch* include a pair of 119–137 (128)μ long *tail setae*, i.e. the ratio their length to the total body length 1 : 6·0–7·9 (6·9).

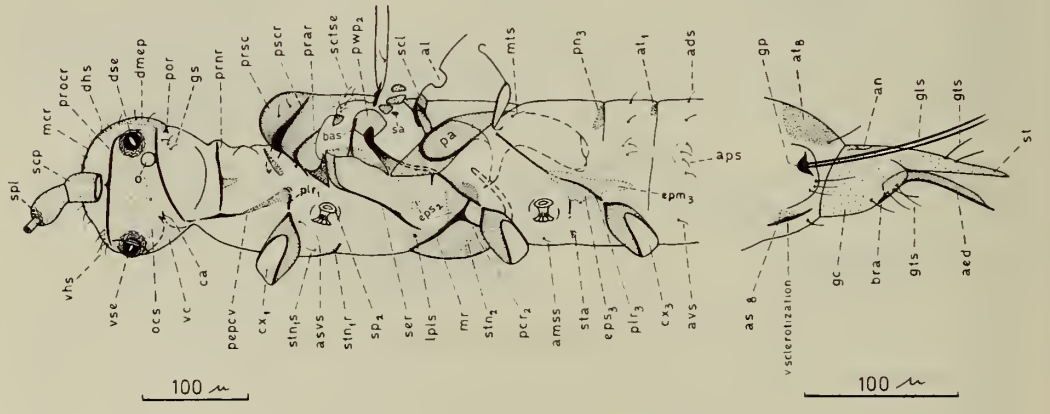


FIG. 42. *Eriococcus orariensis* Hoy, lateral view.

Genital segment : Genital capsule elongate, 119–134 (128)μ long and 43–49 (46)μ wide, the ratio being 2·6–3·0 (2·8) : 1, and the ratio its length to the total length of body 1 : 6·2–7·8 (6·9). *Style* rather straight in lateral view, with a pointed apex. *Anal opening* about 12μ in diameter. *Aedeagus* with a well sclerotized ventral margin and a sharply pointed tip. *Setae of genital segment : Dorsally* 2 comparatively long setae always present on each side of the style at about half its length. *Ventrally* 4–5 (4·6) similar setae occur on each side of the genital capsule.

Material : 10 specimens from two lots examined, all of which entirely agreed with each other. The specimens of one lot were collected by J. M. Kelsey, on *Leptospermum scoparium*, in Ashburton, New Zealand, 10.vi.1948 ; the other specimens were collected by J. M. Hoy, on the same host plant, in Palmerston North, New Zealand, 21.iii.1956.

Eriococcus buxi (Fonscolombe)

(Text-figs. 43, 44)

Macropterous males only known ; living specimens not available. The males moderately robust, comparatively small, with short antennae and moderately long legs. When mounted, 942–1050 (980)μ long, 266–294 (280)μ wide at mesothorax and 1862–2100 (2002)μ wing expanse.

Body setae : Antennae and legs with about 18μ long fleshy setae and somewhat longer hair-like ones ; both types of setae hard to separate. Body itself with hair-like setae only.

Head : Subtetrahedron ; subtriangular in dorsal and front views ; *ventral preocular depression* hardly indicated in lateral view. Length from apex to postoccipital ridge 67–76 (70)μ ; from apex to neck 140–150 (144)μ ; width across the genae 174–183 (180)μ. *Dorsal arm of midcranial ridge* short, joining *lateral* and *ventral arms* at the apex of the head. *Post-occipital ridge* well developed, laterally giving off two branches, one anteriorly and the other *posteriorly*. *Dorsomedial part of epicranium* slightly raised. *Preocular* and *postocular ridges* well separated ; ventral part of the former atrophied. *Preoral ridge* slender. *Eyes : Dorsal simple eyes* not projecting beyond the outer margins of the head ; their corneae 18–24 (21)μ in diameter and separated by 58–61 (59)μ, i.e. 2·4–3·3 (2·7) times their diameter apart. *Ventral simple eyes* 21–24 (22)μ and 18–21 (20)μ apart. *Lateral ocelli* closely attached to postocular ridges. *Ocular sclerites* large. *Cranial apophysis* apically truncate. *Tentorial bridge* stout. *Dorsal head setae* 11–15 (12·8) on each side ; each gena with 9–15 (11·8) *genal setae* ; *setae of ocular sclerites* 10–13 (11·6). *Ventral head setae* on each side : 2–3 (2·6) between the ventral eyes ; 11–15 (13·2) in the area of the ventral preocular depression, forming on both sides a transverse band ; 4–5 (4·2) on each side of the ventral arm of the midcranial ridge.

Antennae : Rather filiform ; 9-segmented ; 458–506 (476)μ long, i.e. about as long as half the total body length, the ratio being 1 : 2·0–2·1 (2·05), and slightly shorter than the hind legs, the ratio 1 : 1·1–1·3 (1·2). *Scape* 37–40 (39)μ long and 34–37 (36)μ wide at base ; always with 4 h.s. *Pedicel* 43–49 (46)μ long and 31–37 (34)μ wide ; with 2–5 (3·5) f.s., 10–16 (13·3) h.s. and a *sensillum placodeum*. *Flagellum :* Flagellar segments 21–24μ wide, with segment III somewhat wider and segment IX somewhat narrower. Segment III club-shaped and longest of all, the ratio its length to the length of terminal segment 2·6–2·9 (2·8) : 1, and the ratio its width to its length 1 : 3·2–3·6 (3·5). Segments IV to VIII rather barrel-shaped, the ratio width to length of segment VIII being 1 : 1·5–1·9 (1·6) ; terminal segment pear-shaped, shortest of all and always with 5–6 apically knobbed *capitate sensory setae*. The following table shows the lengths of the flagellar segments and the number of setae on each :

	III	IV	V	VI	VII	VIII	IX
length in μ	79–89	73–82	49–64	61–67	37–43	37–43	31
(av.)	(85)	(76)	(58)	(64)	(40)	(40)	(31)
f.s.	17–26	18–26	17–26	22–28	11–20	10–16	0
(av.)	(22·1)	(22·5)	(20·5)	(24·5)	(16·3)	(13·3)	0
h.s.	5–9	5–8	3–5	4–8	3–6	4–6	0
(av.)	(7·5)	(6·5)	(3·8)	(5·8)	(4·5)	(4·8)	0
set. ca.	0	0	0	0	0	0	5–6
(av.)	0	0	0	0	0	0	(5·8)

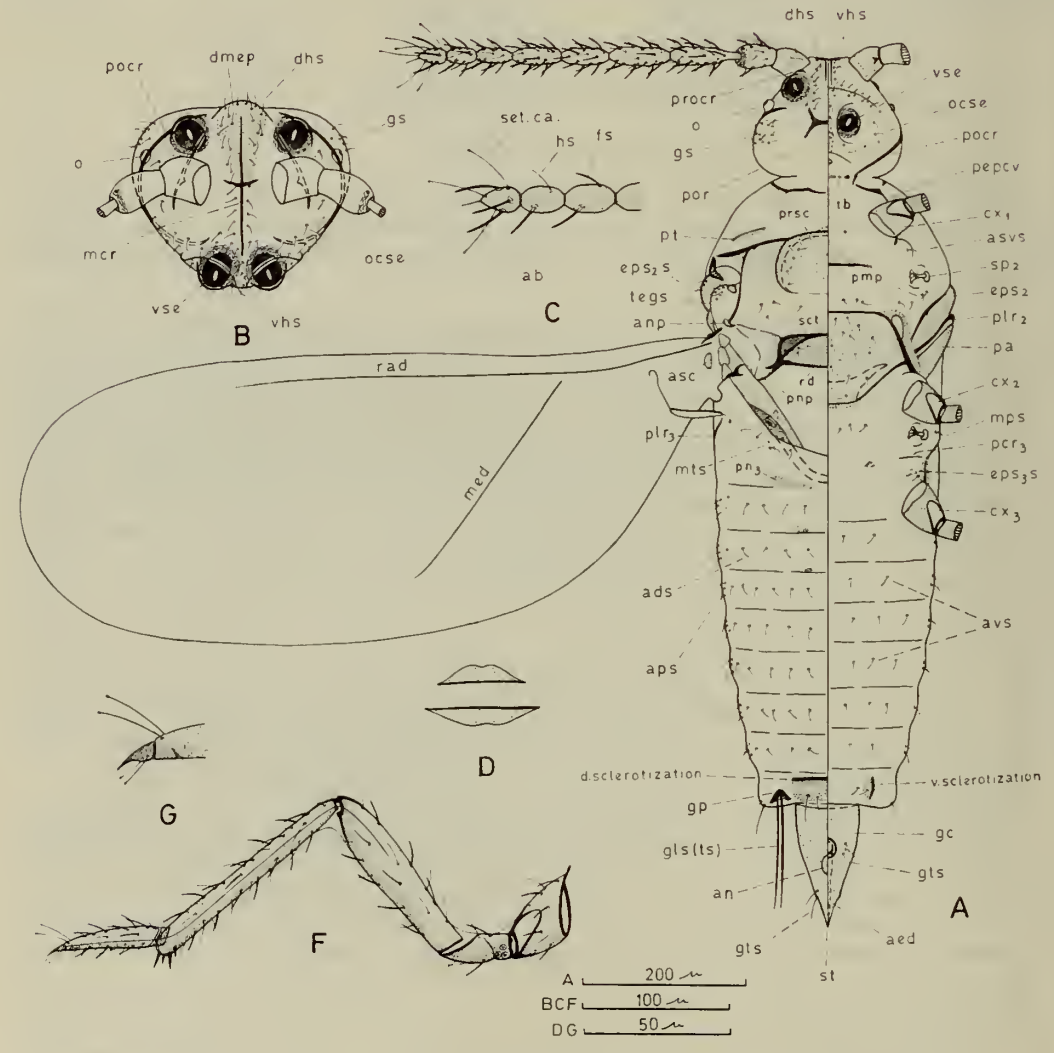


FIG. 43. *Eriococcus buxi* (Fonscolombe), dorsal and ventral view.

Antennal bristles well defined ; segments VII and VIII each with a ventral bristle. Segment IX with three bristles near its base and one apical hair-like seta.

Thorax : 380–418 (403)μ long. *Prothorax : Pronotal ridges* medially interrupted by a weak sclerotization. *Lateral pronotal sclerites* and *post-tergites* small. *Proepisternum* without any ridge-like sclerotization. *Prosternum* triangular, 24–34 (27)μ long ; *prosternal ridge* 92–98 (95)μ long. *Prothoracic setae : Medial, lateral pronotal, post-tergital* and *antespiracular dorsal setae* absent. One *antespiracular ventral seta* always present and one *prosternal seta* usually present (av. 0·8) on each side.

Mesothorax : Prescutum 67–82 (76)μ long and 110–122 (116)μ wide, the ratio being 1 : 1·5–1·7 (1·6) ; laterally bounded by the *prescutal ridges* and posteriorly by the *prescutal suture. Scutum* 43–52 (46)μ long, i.e. the ratio lengths of prescutum to scutum 1·6–1·9 (1·7) : 1. *Prealare, prealar ridge, tegula, anterior* and *posterior notal wing processes* well developed. *Scutellum* 37–46 (40)μ long and 107–122 (116)μ wide, i.e. the ratio 1 : 2·7–3·0 (2·9), and its length to the length of the scutum 1 : 1·1–1·2 (1·15) ; *scutellar ridge* distinct. *Postalare* with the *anterior* and *posterior ridges* joined. *Postnotal apophysis* strong. *Mesopleuron : Mesopleural ridge* continuous above the coxal articulation ; *basalare* slender. *Subepisternal ridge* well developed. *Mesepisternum* distinct and *mesepimeron* small. *Lateropleurite* comparatively large, with an oval membranous area. *Mesosternum : Basisternum* 92–110 (101)μ long and 174–189 (180)μ wide ; antero-laterally and latero-posteriorly bounded by the *marginal* and *precoxal ridges* respectively. *Furca* well developed. *Mesothoracic spiracle* 15–18 (17)μ wide at opening, with a 27–31 (29)μ long supporting bar. *Mesothoracic setae* on each side : *Prescutal setae* 6–9 (7·6) ; *scutal setae* 5–7 (6·1) ; *scutellar setae* 2–3 (2·8). *Tegular setae* 7–9 (7·9). *Anepisternum* with 2–3 (2·8) *mesepisternal setae. Postmesostigmatal setae* in two groups, 3–4 (3·4) latero-ventrally and 2–3 (2·6) medially ; *basisternal setae* 10–15 (11·6). *Metathorax : Metapostnotal sclerites* small ; *metapostnotal ridge* absent. *Metapleural ridge* attenuated as usual towards the small *pleural apophysis. Metepisternum* and *metepimeron* distinct. *Precoxal ridge* weak and *metasternal apophysis* small. *Metathoracic spiracle* identical with the mesothoracic. *Metathoracic setae* on each side : *Metatergal setae* 4–5 (4·2) ; *metapleural setae* 1–2 (1·6) ; *postmetastigmatal setae* 2–3 (2·6). *Anterior metasternal setae* 2–3 (2·4) and *posterior metasternal setae* usually absent, although one seta was found in one specimen.

Wings : 812–924 (868)μ long and 294–350 (322)μ wide ; *alar setae* almost always absent and only one seta may occur (av. 0·1). *Hamulohalterae* 58–67 (64)μ long and 15–18 (16)μ wide ; with one apically hooked, 52–67 (58)μ long seta, i.e. the ratio lengths of seta to hamulohaltera 1 : 1·0–1·1 (1·08).

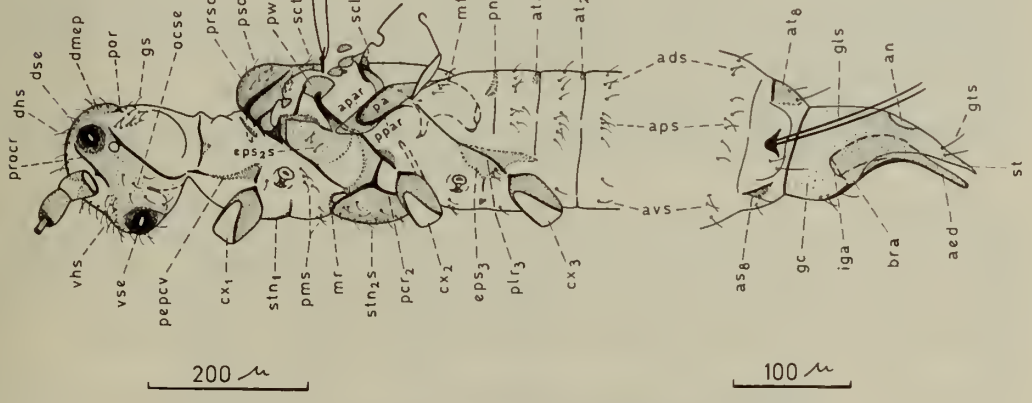


FIG. 44. *Eriococcus buxi* (Fonscolombe), lateral view.

Legs : Moderately long and stout ; the fore and the middle legs of subequal length and shorter than the hind legs ; the ratio length of the hind leg to the total length of the body 1 : 1·8–1·9 (1·85). *Coxa* and *trochanter* about 40 and 24μ wide respectively. *Femur* about 31μ wide ; that of the middle leg shortest and that of the hind leg longest ; the ratio width to length of the hind femur 1 : 4·9–5·2 (5·0). *Tibia* about 18μ wide ; with 2 apical spurs and 2–3 smaller spines ; in the fore leg the femur slightly shorter than the tibia, the ratio their lengths 1 : 1·1–1·2 (1·17). *Tarsus* about 18μ wide ; *tarsal digitules* apically knobbed, about 29μ long. *Claw* broad at base and abruptly tapering to a sharply pointed tip ; *ungual digitules* apically knobbed. The following table shows the lengths of the leg segments (in microns) and the number of setae on each :

		Fore leg	Middle leg	Hind leg
Coxa	length	34–40 (37)	34–40 (37)	37–43 (40)
	f.s.	3–6 (4·2)	3–5 (4·6)	4–6 (5·1)
	h.s.	4–6 (5·2)	4–7 (5·5)	5–8 (6·6)
Trochanter	length	52–55 (54)	52–55 (54)	55–61 (58)
	f.s.	1–3 (1·8)	1–3 (1·6)	1–4 (2·2)
	h.s.	2–4 (2·6)	2–5 (2·9)	2–5 (3·2)
Femur	length	134–150 (143)	122–134 (128)	143–159 (153)
	f.s.	7–12 (9·5)	6–10 (8·1)	7–13 (10·8)
	h.s.	13–19 (15·7)	10–17 (13·3)	12–21 (16·5)
Tibia	length	162–177 (168)	174–186 (180)	186–195 (192)
	f.s.	17–25 (21·7)	20–26 (22·4)	22–30 (27·1)
	h.s.	19–34 (26·6)	23–39 (31·8)	27–41 (35·4)
Tarsus	length	70–73 (72)	70–73 (72)	73–76 (75)
	f.s.	11–15 (12·6)	11–17 (13·1)	13–18 (16·2)
	h.s.	13–18 (15·5)	12–19 (15·9)	16–22 (18·8)
Claw	length	12–15 (14)	12–15 (14)	12–15 (14)
Total length of leg		467–509 (491)	467–506 (488)	509–549 (528)

Abdomen : 304–380 (357)μ long and 251–289 (266)μ wide. Tergites of segments I and II small ; that of segment VIII large, anteriorly bounded by a transverse stripe of heavy sclerotization. Sternites of segment VIII also bounded laterally by a longitudinal, similarly heavy sclerotization. *Ostioles* absent. *Abdominal setae* on each side : *Dorsal setae* 4–6 on segment I, 4–5 on segments II to V, 2–4 on segments VI and VII, and one slightly longer seta on segment VIII. *Pleural setae* 5–7 on segments I to VII and 2–3 on segment VIII, including one slightly longer seta. *Ventral setae* 1–2 on segment II, 2–3 on segments III to VII, and always 2 on segment VIII.

Glandular pouches small ; *setae of glandular pouch* include a pair of 107–122 (113)μ long *tail setae*, i.e. the ratio their length to the total body length 1 : 7·7–9·8 (8·7).

Genital segment : Genital capsule comparatively large, 140–153 (146)μ long and 82–92 (85)μ wide, the ratio being 1·6–1·9 (1·7) : 1, and the ratio its length to the total length of the body 1 : 6·6–6·9 (6·7). *Style* rather straight in lateral view, with a pointed apex. *Anal opening* about 18μ in diameter. *Aedeagus* with the ventral margin well sclerotized ; *internal genital aperture* large. *Setae of genital segment : Dorsally* 2 long setae always present on each side of the style near its apex ; *ventrally* 3 smaller setae occur on each side of the genital capsule.

Material : 7 specimens examined, collected by N. S. Borchsensius, on *Buxus sempervirens*, in Abhasia, U.S.S.R., in 1932 (no exact date given).

OVATICOCCUS Kloet, 1944

Ovaticoccus agavium Douglas

(Text-figs. 45, 46)

Winged forms only known ; these dark reddish brown, with the thorax slightly lighter. The males moderately robust, comparatively small, with moderately short antennae and moderately long legs. Mounted specimens 1050–1204 (1120)μ long, 308–350 (336)μ wide at mesothorax and 2128–2422 (2296)μ wing expanse.

Body setae : Antennae with about 12μ long fleshy setae and about twice as long hair-like ones ; body and legs with hair-like setae only, much smaller than those of the antennae.

Head : Subtetrahedron ; subtriangular in dorsal view and more or less rounded in front view ; *ventral preocular depression* hardly indicated in lateral view. Length from apex to postoccipital ridge 107–125 (116)μ ; from apex to neck 159–177 (167)μ ; width across the genae 198–207 (201)μ. *Dorsal arm of midcranial ridge* anteriorly continuous with the *ventral arm* and posteriorly fading out before reaching the postoccipital ridge ; *lateral arms* indicated by short, weak sclerotizations. *Postoccipital ridge* laterally giving off two small branches, one anteriorly and the other slightly bent posteriorly. *Preocular* and *postocular ridges* well separated ; *preoral ridge* slender. *Eyes : Dorsal simple eyes* not projecting beyond the outer margins of the head in dorsal view ; their corneae 15–18 (17)μ in diameter and both separated by 98–113 (107)μ, i.e. 5·3–7·4 (6·0) times their diameter apart. *Ventral simple eyes* 15–21 (18)μ in diameter and 43–55 (49)μ apart. *Lateral ocellus* vestigial and only represented by a small sclerotized spot on the ocular sclerite, attached to the postocular ridge by means of a short sclerotized arm. *Cranial apophysis* apically bifurcate. *Tentorial bridge* stout. *Mouth opening* posteriorly situated on a small *mouth tubercle*. *Dorsal head setae* 6–9 (7·1) on each side ; each gena with 2–3 (2·1) *genal setae*. *Ventral head setae* on each side : Setae between the ventral eyes absent ; 2–4 (3·1) in the area of the ventral preocular depression, forming on both sides transverse single or double rows ; anteriorly 1–2 (1·8) on each side of the ventral arm of the midcranial ridge.

Antennae : Rather filiform ; 10-segmented ; 601–677 (637)μ long, i.e. as long as or slightly longer than half the body length, the ratio being 1 : 1·6–2·0 (1·8), and about as long as the hind legs, the ratio 1 : 1·0–1·1 (1·07). *Scape* 43–49 (46)μ long and 49–55 (52)μ wide at base ; always with 4 h.s. *Pedicel* 58–64 (61)μ long and 37–43 (40)μ wide ; with 7–11 (8·4) h.s. and a *sensillum placodeum*. *Flagellum :* Flagellar segment 27–31 (29)μ wide, with segments VIII, IX and sometimes VII inconsiderably wider. Segment III club-shaped and longest of all, the ratio its length to the length of the terminal segment 1·7–2·3 (1·9) : 1, and its width to its length 1 : 3·4–4·2 (4·0). Segments IV to IX rather barrel-shape ; the ratio width to length of segment IX 1 : 1·4–1·8 (1·6). Terminal segment pear-shaped, with a narrowly constricted or even pointed apex. Segments VI to X and sometimes V also, with a number of apically knobbed, *capitate sensory setae*. In the following table, the lengths of the flagellar segments and the number of setae on each are given :

	III	IV	V	VI	VII	VIII	IX	X
length in μ	101–116	61–76	61–76	61–73	52–64	49–61	46–61	46–64
(av.)	(110)	(67)	(66)	(66)	(58)	(55)	(55)	(58)
f.s.	2–7	4–7	5–10	4–12	6–11	5–11	3–6	2–5
(av.)	(4·2)	(5·6)	(6·6)	(9·2)	(8·4)	(7·4)	(4·3)	(3·7)
h.s.	7–14	4–8	5–8	2–4	0–3	0–2	0–2	1–2
(av.)	(11·2)	(6·0)	(6·1)	(3·2)	(1·3)	(1·0)	(1·1)	(2·0)
Set. ca.	0	0	0–1	2–4	3–4	3–5	3–6	3–5
(av.)	0	0	(0·4)	(3·1)	(3·6)	(4·3)	(4·2)	(3·6)

Antennal bristles well defined ; segments VIII and IX each with one ventral bristle. Segment X with 3 bristles, the dorsal of which slightly shorter and nearer to the apex ; the segment also with one apical hair-like seta.

Thorax : 388–494 (448)μ long. *Prothorax : Pronotal ridges* medially interrupted at a weakly sclerotized point. *Lateral pronotal sclerites* and *post-tergites* small. *Proepisternum* without any ridge-like sclerotization. *Prosternum* triangular, 34–46 (40)μ long ; *prosternal ridge*

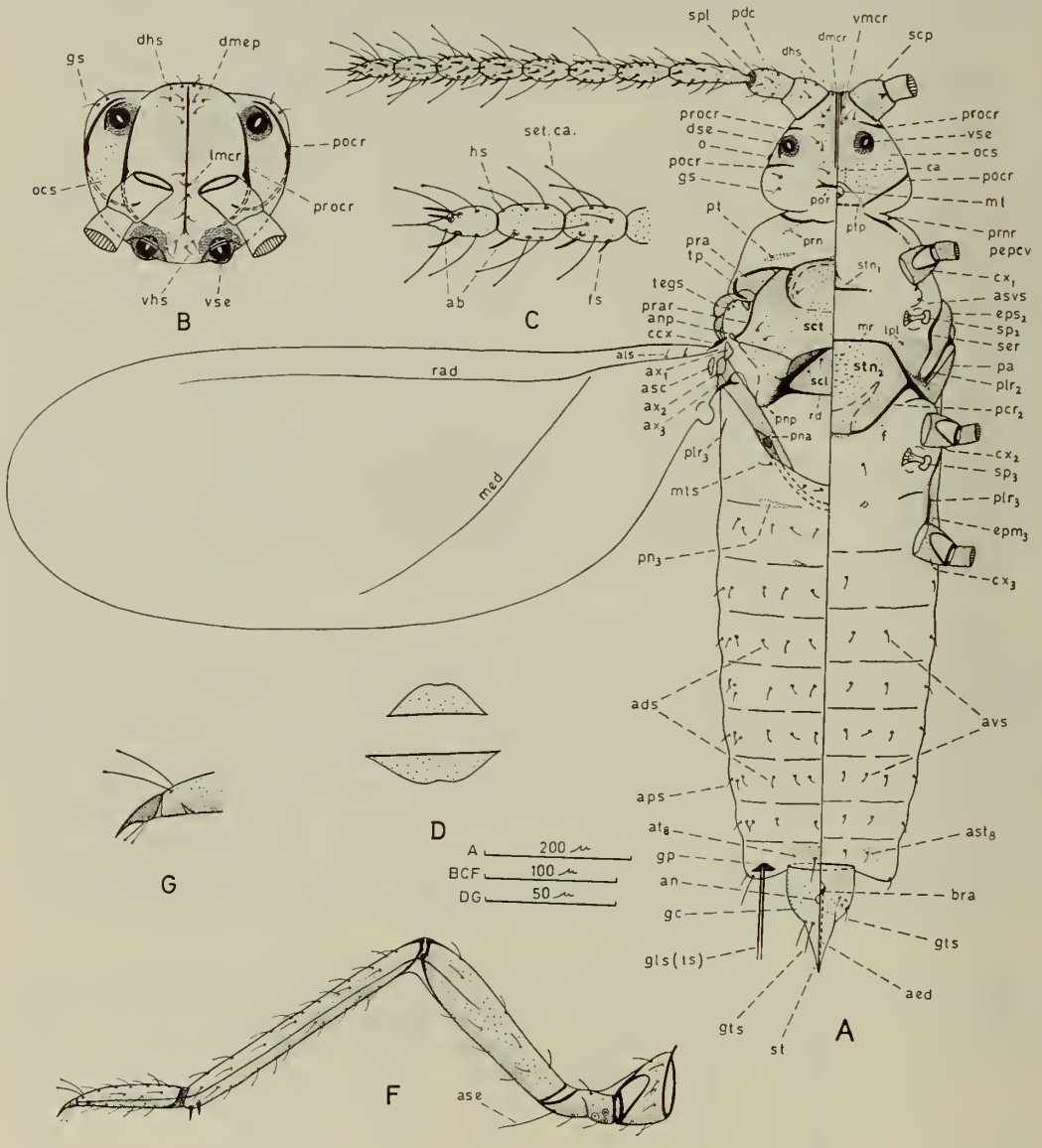


FIG. 45. *Ovaticoccus agavium* Douglas, dorsal and ventral view.

92–107 (95)μ long. *Prothoracic setae : Medial, lateral pronotal, post-tergital* and *antespiracular dorsal setae* absent. One *antespiracular ventral seta* always present on each side ; *prosternal setae* absent.

Mesothorax : Prescutum 58–70 (64)μ long and 122–140 (131)μ wide, the ratio being 1 : 1·9–2·3 (2·0) ; laterally and posteriorly bounded by the *prescutal ridge* and the *prescutal suture* respectively. *Scutum* 49–61 (52)μ long, i.e. the ratio lengths of prescutum and scutum 1·1–1·4 (1·2) : 1. *Prealare, prealar ridge, triangular plate* and the mesopleural structures well developed. *Scutellum* 61–70 (67)μ long and 113–131 (122)μ wide, i.e. the ratio 1 : 1·6–2·0 (1·8), and its length to the length of the scutum 1·1–1·4 (1·3) : 1 ; *scutellar ridge* strongly developed. *Anterior* and *posterior postalar ridges* anteriorly joined. *Postnotal apophysis* well developed. *Mesopleuron : Mesopleural ridge* continuous above the coxal articulation ; *basalare* slender. *Subepisternal ridge* distinct. *Mesepisternum* and *mesepimeron* well defined. *Latero-pleurite* comparatively large. *Mesosternum : Basisternum* 116–134 (125)μ long and 192–211 (201)μ wide ; *marginal, precoxal ridges* and *furca* well developed. *Mesothoracic spiracle* 21–24 (22)μ wide at opening, with a 43–49 (46)μ long supporting bar. *Mesothoracic setae* on each side : *Prescutal setae* 0–1 (0·4) ; *scutal setae* usually 1–2 and occasionally 3 (av. 1·6) ; *scutellar setae* 1–2 (1·9). *Tegular setae* 2–3 (1·8). *Postmesostigmatal,* and *basisternal setae* absent. *Metathorax : Metapostnotal sclerites* small ; *metapostnotal ridge* absent. *Metapleural ridge* attenuating near the middle as usual ; *metapleural wing process* missing. *Metepisternum* and *metepimeron* small. *Precoxal ridge* weak and *metasternal apophysis* small. *Metathoracic spiracle* similar to the mesothoracic. *Metathoracic setae* on each side : *Metatergal setae* 3–4 (3·4) ; *metapleural setae* absent. *Anterior metasternal seta* 0–1 (0·6) ; posterior *metasternal setae* absent.

Wings : 910–1050 (994)μ long and 308–392 (350)μ wide ; always with 2 *alar setae.* The *hamulohalterae* and the *suspensorial sclerites* absent.

Legs : Moderately long and stout ; the fore and the middle legs of subequal length and shorter than the hind legs ; the ratio length of hind leg to the total length of body 1 : 1·5–1·8 (1·6). *Coxa* about 55 and *trochanter* about 31μ wide respectively ; the latter with one, about 46μ long differentiated *apical seta. Femur* about 40μ wide ; that of the middle leg shortest and those of the fore and hind legs subequal ; the ratio width to length of the hind femur 1 : 4·3–4·7 (4·5). *Tibia* about 24μ wide ; with 2 apical spurs ; in fore leg the femur slightly shorter than the tibia, the ratio their lengths 1 : 1·2–1·4 (1·3). *Tarsus* about 18μ wide ; *tarsal*

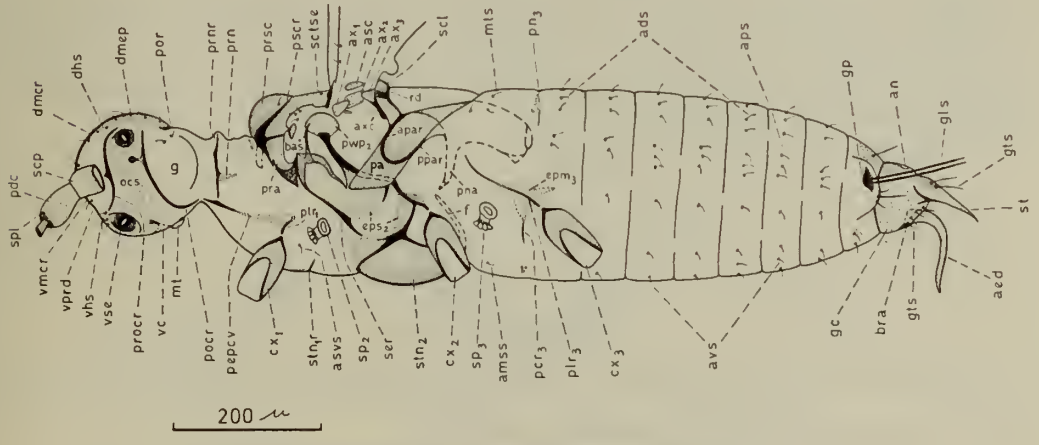


Fig. 46. *Ovaticoccus agavium* Douglas, lateral view.

digitules apically knobbed, 31–37 (34)μ long. *Claw* broad at base, abruptly tapering towards a sharply pointed tip ; *ungual digitules* apically knobbed. In the following table the lengths of the leg segments (in microns) and the number of setae on each are given :

		Fore leg	Middle leg	Hind leg
Coxa	length	37–43 (39)	37–43 (39)	40–46 (42)
	h.s.	6–10 (7·6)	6–11 (8·1)	7–11 (9·2)
Trochanter	length	61–70 (64)	64–70 (67)	70–76 (73)
	h.s.	2–4 (2·8)	2–4 (3·0)	2–5 (3·4)
Femur	length	174–189 (183)	153–171 (165)	174–186 (180)
	h.s.	11–18 (14·6)	10–16 (12·8)	11–16 (13·6)
Tibia	length	226–253 (238)	232–259 (244)	250–293 (272)
	h.s.	29–38 (33·2)	30–42 (36·1)	32–46 (38·4)
Tarsus	length	82–92 (85)	85–95 (89)	89–101 (95)
	h.s.	17–23 (19·2)	16–23 (19·6)	18–25 (21·2)
Claw	length	18–24 (21)	18–24 (21)	18–24 (21)
Total length of leg		613–659 (631)	607–656 (625)	659–720 (683)

Abdomen : 342–471 (410)μ long and 296–334 (319)μ wide. Tergites of segment I small ; that of segment VIII large. Sternites of segment VIII ill-defined. *Ostioles* absent. *Abdominal setae* on each side : *Dorsal setae* 3–4 on segments I to V, 2–3 on segments VI and VII, and one slightly longer seta on segment VIII. *Pleural setae* 2–3 on segment I, 3–4 on segments II to VII, and 3 on segment VIII, including a slightly longer seta. *Ventral setae* 1–2 on segments II and III, 2–3 on segments IV to VII, and 2 on segment VIII.

Setae of glandular pouch include a pair of 116–140 (128)μ long *tail setae*, the ratio their length to the total body length being 1 : 7·7–10·3 (8·8).

Genital segment : Genital capsule moderately large, 128–143 (134)μ long and 85–95 (89)μ wide, i.e. the ratio 1·4–1·6 (1·5) : 1, and the ratio its length to the total length of body 1 : 7·8–8·9 (8·4). *Style* rather straight in lateral view, apically pointed. *Anal opening* about 12μ in diameter. *Aedeagus* tubular, with a short, strongly sclerotized *basal rod*. *Setae of genital segment : Dorsally* 2 long setae present on each side of the style near its base ; *ventrally*, 4–6 (5·1) smaller setae occur on each side of the genital capsule.

Material : 10 specimens examined, obtained from the following two lots, both of which completely agreed with each other : (A) 5 specimens collected by K. Boratynski, on *Agave decipiens*, in Kew Gardens, England, 27.vi.1957. (B) 5 specimens collected by myself, on *Agave franzosinii*, also in Kew Gardens, England, during the last two weeks of June, 1964.

This species was also recorded by Dr. Boratynski on *Agave parryi*.

GOSSYPARIA Signoret, 1875

Gossyparia spuria (Mod.)

(Text-figs. 47–49)

Macropterous and brachypterous forms of this species were available for study.

(A) *The macropterous form* (Text-figs. 47 and 48)

The males moderately robust, comparatively large, with short antennae and short legs.

When mounted 1442–1512 (1484)μ long, 392–420 (406)μ wide and 2520–2758 (2632)μ wing expanse.

Body setae : Antennae with numerous fleshy and few hair-like setae, about 37μ long ; body and legs with much shorter hair-like setae only.

Head : Subtetrahedron ; subtriangular in dorsal view and more or less rounded in front view ; *ventral preocular depression* absent in lateral view. Length from apex to postoccipital ridge 122–131 (127)μ ; from apex to neck 189–198 (194)μ ; width across the genae 238–250

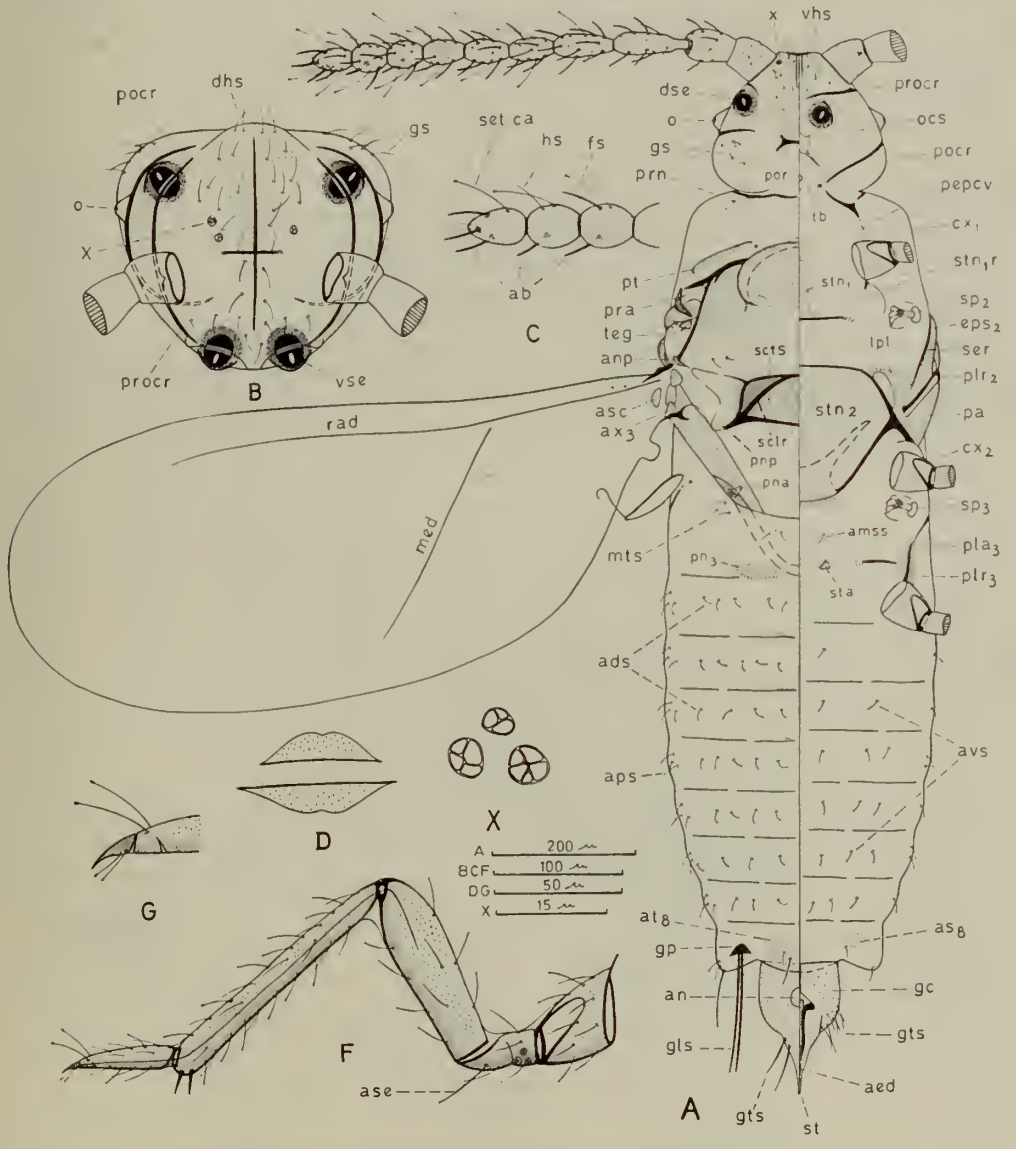


FIG. 47. *Gossyparia spuria* (Mod.), macropterous form, dorsal and ventral view.

(244)μ. *Midcranial ridge* well developed and cruciform ; *dorsal arm* short, joining the *lateral* and the *ventral arms* at the apex of the head. *Postoccipital ridge* laterally bending posteriorly and giving off short, heavily sclerotized extensions anteriorly. *Pre-* and *postocular ridges* well separated ; *preoral ridge* slender. *Eyes : Dorsal simple eyes* slightly projecting beyond the outer margins of the head in dorsal view ; their corneae 24–27 (26)μ in diameter and separated by 128–137 (134)μ, i.e. 5·0–5·6 (5·3) times their diameter apart. *Ventral simple eyes* equal to the dorsal in diameter and 37–40 (39)μ apart. *Lateral ocelli* large, closely attached to post-ocular ridge. *Cranial apophysis* apically bifurcate. *Anterior tentorial arms* join the cranial apophysis separately ; *tentorial bridge* stout. *Dorsal head setae* 10–14 (11·8) on each side ; each gena with 4–6 (5·0) *genal setae*. *Ventral head setae :* Setae between the ventral eyes absent ; 3–5 (4·1) just anterior to the preocular ridges, forming on both sides a transverse irregular row ; 2–3 (2·5) on each side of the ventral arm of the midcranial ridge.

One and sometimes two (av. 1·2) small bodies of unknown homology (X) occur dorsally on each side of the dorsal arm of the midcranial ridge, near the apex of the head.

Antennae : Rather moniliform ; 10-segmented ; 625–677 (653)μ long, i.e. somewhat shorter than half the length of the body, the ratio being 1 : 2·2–2·4 (2·3), and equal or slightly shorter than the hind legs, the ratio 1 : 1·0–1·2 (1·1). *Scape* 52–55 (54)μ long and 55–58 (57)μ wide at base ; with 4–5 (4·5) h.s. *Pedicel* 67–70 (69)μ long and 49μ wide ; with 3–5 (4·0) f.s., 2–4 (3·0) h.s. and a *sensillum placodeum*. *Flagellum :* Flagellar segments IV to VII 31–37 (34)μ wide ; segments III and X slightly narrower and segments VIII and IX slightly wider. Segment III club-shaped and longest of all, the ratio its length to the length of segment X being 1·7–1·9 (1·8) : 1, and its width to its length 1 : 3·1–3·6 (3·4). Segments IV to IX barrel-shaped, the ratio width to length of segment IX 1 : 1·2–1·5 (1·4). Terminal segment pear-shaped. Segments V to X and sometimes IV also, with a few apically knobbed, *capitate sensory setae*. The following table shows the lengths of the flagellar segments and the number of setae on each :

	III	IV	V	VI	VII	VIII	IX	X
length in μ	95–98	82–85	61–67	61–70	58–64	49–55	49–55	52–58
(av.)	(97)	(84)	(64)	(66)	(61)	(52)	(52)	(55)
f.s.	4–8	15–19	7–10	8–12	10–13	10–14	9–12	8–11
(av.)	(6·0)	(17·0)	(8·5)	(10·0)	(11·5)	(12·0)	(10·5)	(9·5)
h.s.	3–4	3–5	2–3	1–3	1–2	1–2	1–2	1–2
(av.)	(3·5)	(4·0)	(2·5)	(2·0)	(1·5)	(1·5)	(1·5)	(1·5)
Set. ca.	0	0–1	3–4	2–4	3–4	2–4	3–4	3–4
(av.)	0	(0·5)	(3·5)	(3·0)	(3·5)	(3·0)	(3·5)	(3·5)

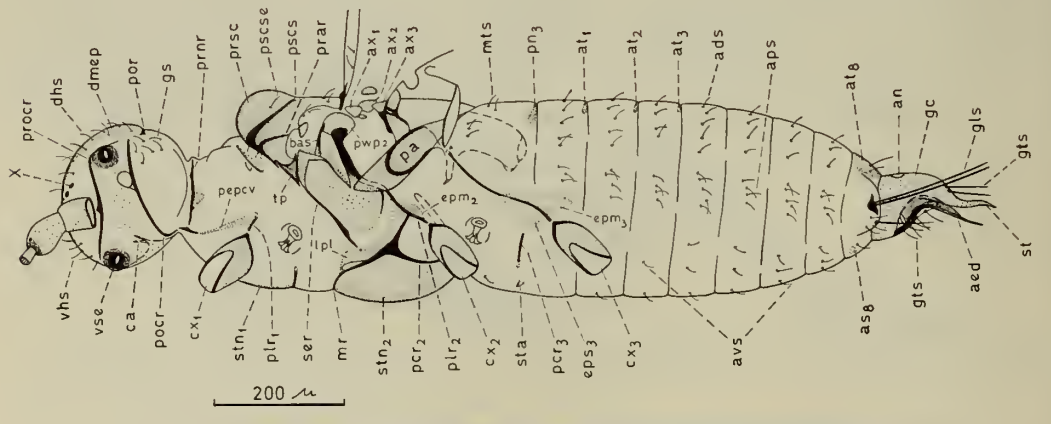


FIG. 48. *Gossyparia spuria* (Mod.), macropterous form, lateral view.

Antennal bristles subequal to the fleshy setae in length ; segments VIII and IX each with one ventral bristle. Terminal segment with one dorsal preapical bristle, two lateral ones at a greater distance from the apex and two apical small setae.

Thorax : 585–623 (608)μ long. *Pronotal ridges* medially interrupted at a weakly sclerotized point ; *lateral pronotal sclerites* small and *post-tergites* narrow. *Proepisternum* without any ridge-like sclerotization. *Prosternum* comparatively long and narrow, 82–85 (84)μ long ; posteriorly bounded by a 119–125 (122)μ long *prosternal ridge*. *Prothoracic setae* absent altogether.

Mesothorax : Prescutum 89–98 (95)μ long and 171–174 (173)μ wide, the ratio being 1 : 1·8–2·0 (1·9) ; *prescutal ridge* well developed and *prescutal suture* distinct. *Scutum* 91–95 (94)μ long, i.e. the ratio lengths of prescutum to scutum 1 : 0·9–1·1 (1·0). *Prealare, prealar ridge, tegular, triangular plate, anterior* and *posterior notal wing processes* well developed. *Scutellum* 70–73 (72)μ long and 159–168 (165)μ wide, the ratio being 1 : 2·2–2·4 (2·3), and its length to the length of scutum 1 : 1·2–1·4 (1·3) ; *scutellar ridge* well developed. *Postalare* with *anterior* and *posterior ridges* joined. *Postnotal apophysis* large. *Mesopleuron : Mesopleural ridge* continuous above the coxal articulation. *Basalare* comparatively slender. *Subepisternal ridge* well developed. *Mesepisternum* distinct and *mesepimeron* small. *Latero-pleurite* large, with an oval membranous area. *Mesosternum : Basisternum* 183–195 (189)μ long and 241–250 (247)μ wide ; *marginal, precoxal ridges* and *furca* well developed. *Mesothoracic spiracle* 21–24 (23)μ wide at opening, with a 46–52 (49)μ long supporting bar. *Mesothoracic setae* on each side : One *prescutal setae* always present ; *scutal* as well as *scutellar setae* 2–3 (2·5). *Tegular setae* always 2. *Postmesostigmatal* and *basisternal setae* absent. *Metathorax : Meta-postnotal sclerites* ill-defined ; *metapostnotal ridge* absent. *Metapleural ridge* attenuated as usual near the middle ; dorsally supporting a small *pleural wing process*. *Precoxal ridge* strong and *metasternal apophysis* distinct. *Metathoracic spiracle* identical with the meso-thoracic. *Metathoracic setae :* 4–5 (4·5) *metatergal setae* and one *anterior metasternal seta* present on each side ; *metapleural* and *posterior metasternal setae* absent.

Wings : 1064–1148 (1106)μ long and 420–490 (462)μ wide ; always with 2 *alar setae*. *Hamulohalterae* 92μ long and 24–27 (26)μ wide ; with one, 52–58 (55)μ long apically hooked seta, the ratio its length to the length of the hamulohaltera being 1 : 1·6–1·8 (1·7).

Legs : Well developed, short and stout ; the middle legs usually shortest and the hind legs longest ; the ratio length of the hind leg to the total length of body 1 : 2·1–2·2 (2·15). *Coxa* and *trochanter* about 64 and 37μ wide respectively ; the latter with a differentiated long *apical seta*. *Femur* about 46μ wide ; that of the middle leg shortest and those of the fore and hind legs subequal ; the ratio width to length of the hind femur 1 : 3·5–4·0 (3·8). *Tibia* about 24μ wide ; with 2 apical spurs ; in fore leg the femur slightly shorter than the tibia, the ratio their lengths being 1 : 1·2–1·4 (1·3). *Tarsus* about 21μ wide ; *tarsal digitules* apically knobbed, about 37μ long. *Claw* broad at base, abruptly tapering apically ; *ungual digitules* also apically knobbed. The following table shows the lengths of the leg segments (in microns) and the number of setae on each :

		Fore leg	Middle leg	Hind leg
Coxa	length	55–61 (58)	55–61 (58)	58–64 (61)
	h.s.	8–12 (9·4)	8–11 (9·1)	10–14 (11·6)
Trochanter	length	73–76 (74)	73–76 (74)	76–79 (77)
	h.s.	4–6 (5·1)	4–5 (4·6)	4–6 (5·3)
Femur	length	159–186 (174)	146–165 (156)	162–183 (174)
	h.s.	15–22 (18·5)	14–20 (16·8)	14–18 (15·9)
Tibia	length	214–238 (229)	217–244 (232)	226–259 (247)
	h.s.	18–29 (24·4)	20–34 (27·6)	22–35 (28·8)

Tarsus	length	67–76 (73)	67–79 (74)	70–82 (76)
	h.s.	10–12 (11·1)	10–13 (11·8)	11–15 (13·3)
Claw	length	21–24 (23)	21–24 (23)	21–24 (23)
Total length of leg		589–659 (628)	580–647 (613)	613–689 (656)

Abdomen : 540–578 (560)μ long and 380–410 (395)μ wide. Tergites of segments I, II and sometimes III weak and narrow ; that of segment VIII large. Sternites of segment VIII ill-defined. *Ostioles* absent. *Abdominal setae* on each side : *Dorsal setae* 4–6 on segments I to IV, 3–4 on segment V, 3 on segments VI and VII, and 2–3 on segment VIII, including a slightly longer seta. *Pleural setae* 3–4 on segments I and II, 4–5 on segments III to VII, and 4 on segment VIII, including a considerably longer seta (about 90μ long). *Ventral setae* 1 on segment II, 2–3 on segments III to VII, and 1 on segment VIII.

Setae of glandular pouch only include a pair of 168–177 (173)μ long *tail setae*, the ratio their length to the total length of body being 1 : 8·1–9·0 (8·6).

Genital segment : Genital capsule moderately large, 177–183 (180)μ long and 110μ wide, i.e. the ratio 1·6–1·7 (1·65) : 1, and the ratio its length to the total length of body 1 : 8·1–8·3 (8·2). *Style* undulating and apically pointed in alteral view. *Anal opening* about 24μ in diameter. *Aedeagus* with well sclerotized lateral margins and tapering towards a sharply pointed tip. *Setae of genital segment* on each side : *Dorsally* two conspicuously long setae always present near the base of the style ; *ventrally* 7–9 (8·0) slightly smaller setae occur on the genital capsule.

Material : 3 specimens only were available, collected by A. Dziedzicka, on *Ulmus* sp., in Mogila, nr. Nowa Huta, nr. Krakow, Poland, 26.iv.1963.

(B) *The brachypterous form* (Text-fig. 49)

These males rather robust, with the abdomen slightly broader than the thorax ; comparatively large, with short antennae and short legs. Mounted specimens 1274–1470 (1358)μ long, 336–378 (350)μ wide at mesothorax and 546–938 (686)μ wing expanse.

Body setae : Antennae with numerous fleshy and a few hair-like setae, about 31μ long. Body and legs with much shorter hair-like setae only.

Head : Subtetrahedron ; subtriangular in dorsal view and rather rounded in front view ; *ventral preocular depression* absent. Length from apex to postoccipital ridge 128–153 (140)μ ; from apex to neck 183–214 (192)μ ; width across the genae 226–244 (235)μ. *Midcranial ridge* cruciform. *Postoccipital ridge* laterally forked into anteriorly and posteriorly directed branches. *Dorsomedial part of epicranium* slightly raised. *Pre-* and *postocular ridges* well separated ; *preoral ridge* slender. *Eyes : Dorsal simple eyes* slightly projecting beyond the outer margins of the head in dorsal view ; their corneae 15–21 (18)μ in diameter and separated by 140–156 (150)μ ; i.e. 6·7–9·8 (8·2) times their diameter apart. *Ventral simple eyes* 12–18 (16)μ in diameter and 61–82 (70)μ apart. *Ocellus* vestigial and only represented by a sclerotized spot, attached to the postocular ridge by means of a slender sclerotized arm. *Cranial apophysis* apically bifurcate. *Tentorial bridge* stout ; *anterior tentorial arms* join the cranial apophysis separately (Text-fig. 46, I). *Mouth opening* situated on a large mouth tubercle posteriorly. *Dorsal head setae* 8–14 (10·1) on each side ; each gena usually with 2–4 and occasionally 1 or 5 (av. 2·9) *genal setae*. *Ventral head setae :* Setae between the ventral eyes absent ; 3–5 (4·2) just anterior to the preocular ridges, forming on both sides a transverse irregular row ; 1–2 (1·6) on each side of the ventral arm of the midcranial ridge.

A small body of unknown homology (X) always present on each side of the dorsal arm of the midcranial ridge, near the apex of the head.

Antennae : Rather moniliform ; 10-segmented ; 491–583 (534)μ long, i.e. shorter than

half the length of body, the ratio being 1 : 2·3–2·7 (2·5), and slightly shorter than the hind legs, the ratio about 1 : 1·1. *Scape* 46–58 (52)μ long and 61–70 (64)μ wide at base ; almost always with 4 and occasionally 5 h.s. (av. 4·2). *Pedicel* 58–67 (61)μ long and 46–52 (50)μ wide ; with 1–4 (2·2) f.s., 3–7 (5·5) h.s. and a *sensillum placodeum*. *Flagellum :* Flagellar segments III to IX 37–43μ wide (segments VI, VII and sometimes VIII somewhat wider than the preceding segments) ; segment X 31–34μ wide. Segment III club-shaped and longest of all, the ratio its length to the length of segment X 1·5–2·0 (1·8) : 1, and its width to its length 1 : 1·8–2·3 (2·1). Segments IV to IX barrel-shaped, the ratio width to length of segment IX being 1 : 0·9–1·1 (1·0). Terminal segment pear-shaped. Segments VI to X and sometimes V also, with a few apically knobbed *capitate sensory setae*. The lengths of the flagellar segments and the number of setae on each are given in the following table :

	III	IV	V	VI	VII	VIII	IX	X
length in μ	73–92	46–58	46–61	46–61	43–55	37–46	37–46	43–55
(av.)	(82)	(49)	(58)	(55)	(49)	(43)	(40)	(46)
f.s.	7–15	7–11	8–16	12–17	13–17	7–14	8–12	4–8
(av.)	(11·9)	(9·2)	(11·8)	(14·1)	(14·9)	(10·3)	(9·2)	(5·1)
h.s.	3–6	1–3	1–3	1–3	1–2	0–2	0–1	0–1
(av.)	(5·1)	(2·1)	(1·9)	(1·1)	(1·2)	(0·8)	(0·5)	(0·4)
set. ca.	0	0	0–2	1–4	2–5	2–5	2–4	3–4
(av.)	0	0	(1·1)	(1·9)	(3·2)	(3·1)	(2·6)	(3·6)

Antennal bristles well defined ; segments VIII and IX each with one ventral bristle. Segment X with one dorsal preapical bristle, two lateral ones at a greater distance from the apex and two apical small hair-like setae.

Thorax : 372–471 (426)μ long. *Pronotal ridges* medially interrupted at a weakly sclerotized point ; *lateral pronotal sclerites* and *post-tergites* small. *Proepisternum* without any ridge-like sclerotization. *Prosternum* narrow, 24–34 (27)μ long ; *prosternal ridge* 79–92 (89)μ long. *Prothoracic setae* almost always absent but one *medial pronotal*, one *lateral pronotal* and one *antespiracular dorsal seta* were found on each side of one specimen.

Mesothorax : Prescutum 43–52 (46)μ long and 122–143 (131)μ wide, the ratio being 1 : 2·5–3·2 (2·9) ; *prescutal ridge* slender and *prescutal suture* distinct. *Scutum* 31–55 (49)μ long, i.e. the ratio lengths of prescutum to scutum 1 : 0·7–1·4 (1·1). *Prealare, prealar ridge, tegula* and *triangular plate* conspicuously degenerate. *Scutellum* trapezoid in dorsal view ; 43–61 (55)μ long and 159–183 (168)μ wide, the ratio being 1 : 2·6–3·7 (3·1), and its length to the length of scutum 1·0–1·5 (1·1) : 1 ; *scutoscutellar suture* weakly developed and usually partly missing ; *scutellar ridge* absent. *Postalare* with the *anterior* and *posterior ridges* anteriorly joined. *Postnotal apophysis* greatly reduced. *Mesopleuron : Mesopleural ridge* continuous above the coxal articulation, dorsally supporting a small *pleural wing process*. *Basalare* extremely weak and slender. *Subepisternal ridge* atrophied and sometimes absent altogether. *Mesepisternum* well-defined and *mesepimeron* small. *Lateropleurite* comparatively large, with a small oval membranous area. *Mesosternum : Basisternum* 107–131 (119)μ long and 177–201 (186)μ wide ; *marginal ridge* usually partly absent anteriorly ; *precoxal ridge* slender and *furca* greatly reduced. *Mesothoracic spiracle* 18–24 (21)μ wide at opening, with a 46–52 (49)μ long supporting bar. *Mesothoracic setae* on each side : *Prescutal setae* absent ; *scutal setae* 1–5 (2·9) ; *scutellar setae* 1–3 (1·8). *Tegular setae* 0–1 (0·2). *Postmesostigmatal* and *basisternal setae* absent. *Metathorax : Metapostnotal sclerites* narrow ; *metapostnotal ridge* absent. *Metapleural ridge* weak, attenuated near the middle as usual, and dorsally reduced. *Precoxal ridges* absent and *metasternal apophysis* vestigial. *Metathoracic spiracle* similar to the mesothoracic. *Metathoracic setae* on each side : *Metatergal setae* 3–8 (4·7) and *anterior metasternal setae* 0–1 (0·9) ; *metapleural setae* absent and *posterior metasternal setae* 0–1 (0·3).

Wings : Greatly reduced ; 126–308 (182)μ long and 42–140 (84)μ wide ; *axillary sclerites* small ; *additional sclerite* and *alar lobe* absent ; one *alar seta* almost always present and

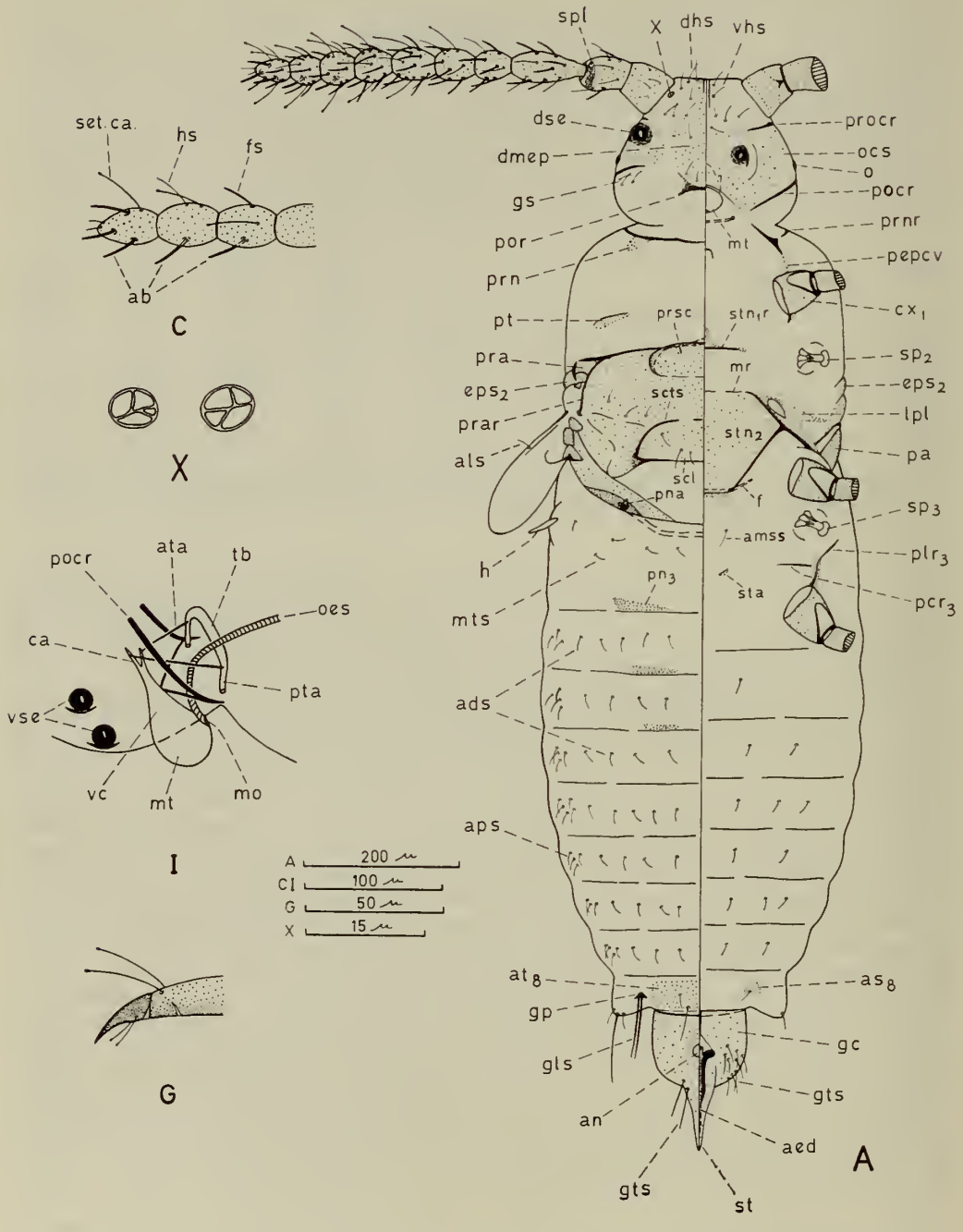


FIG. 49. *Gossyparia spuria* (Mod.), brachypterous form, dorsal and ventral view.

occasionally absent (av. 0·8). *Hamulohalterae* atrophied and sometimes absent altogether ; when present, 31–52 (40)μ long and 12–18 (15)μ wide ; the hamulohalteral ridge and the seta absent.

Legs : Well developed, short and stout ; the middle legs usually shortest and the hind legs longest ; the ratio length of the hind leg to the total length of body 1 : 2·2–2·4 (2·3). *Coxa* and *trochanter* about 64 and 37μ wide respectively ; the latter with a long *apical seta*. *Femur* about 49μ wide ; that of the middle leg shortest and those of the fore and hind legs subequal ; the ratio width to length of the hind femur 1 : 2·9–3·4 (3·1). *Tibia* about 31μ wide ; with 2 apical spurs ; in fore leg the femur shorter than the tibia, the ratio their lengths being 1 : 1·1–1·2 (1·15). *Tarsus* about 27μ wide ; *tarsal digitules* apically knobbed, about 34μ long. *Claw* wide at base, abruptly tapering apically ; *ungual digitules* apically knobbed. The lengths of the leg segments (in microns) and the number of setae on each are given in the following table :

		Fore leg	Middle leg	Hind leg
Coxa	length	52–58 (55)	52–58 (55)	55–61 (58)
	h.s.	7–11 (9·5)	7–10 (8·9)	8–13 (11·7)
Trochanter	length	64–70 (67)	64–70 (68)	70–79 (73)
	h.s.	4–5 (4·5)	4–5 (4·4)	4–6 (5·1)
Femur	length	143–168 (156)	134–153 (143)	140–168 (153)
	h.s.	11–16 (13·1)	8–12 (10·4)	9–13 (11·8)
Tibia	length	168–189 (180)	168–189 (180)	177–214 (198)
	h.s.	16–22 (18·5)	15–23 (19·1)	14–21 (18·2)
Tarsus	length	70–76 (72)	70–79 (74)	73–85 (79)
	h.s.	9–12 (10·7)	9–13 (11·2)	11–14 (12·5)
Claw	length	21–24 (22)	21–24 (22)	21–24 (22)
Total length of leg		516–583 (549)	506–570 (540)	534–622 (583)

Abdomen : 570–646 (608)μ long and 365–426 (395)μ wide. Tergites of segments I and II weak and narrow ; that of segment VIII large. Sternites of segment VIII ill-defined. *Ostioles* absent. *Abdominal setae* on each side : *Dorsal setae* usually 3–5 on segments I to VI (sometimes 7 on segment I and 6 on segments II and IV), 2–4 on segments VII and VIII, including a slightly longer seta on the latter. *Pleural setae* 3–4 and sometimes 5 on segments I to VII, and always 4 on segment VIII, including one considerably longer seta (85–95, av. 89μ long). *Ventral setae* 1 on segment II, 1–2 on segment III, 2–3 on segments IV to VII, and 1–2 on segment VIII.

Glandular pouches comparatively very small ; *setae of glandular pouch* only include a pair of comparatively short *tail setae*, 46–92 (73)μ long, i.e. the ratio their length to the total length of body 1 : 15·2–26·3 (18·6).

The appearance and structure of the *genital segment* similar to that of the macropterous form ; *genital capsule* 162–192 (177)μ long and 113–131 (122)μ wide, the ratio 1·4–1·5 (1·45) : 1, and the ratio its length to the total length of body 1 : 7·0–8·1 (7·7). *Anal opening* 15–21 (18)μ in diamter. *Setae of genital segment* on each side : *Dorsally* two long setae always present near the base of the *style ; ventrally* 8–12 (9·6) slightly smaller setae occur on the genital capsule.

Material : 10 specimens examined, received in two lots as follows :

1. 5 specimens collected by A. Dziedzicka, on *Ulmus* sp., in Krakow, Poland, during May, 1964.
2. 5 specimens also collected by A. Dziedzicka, on *Ulmus* sp., in Moglia, nr. Krakow, Poland, 26.iv.1963.

Gossyparia salicicola Borchsenius

(Text-figs. 50, 51)

Brachypterous form only known. The males rather robust, with the abdomen slightly broader than the thorax ; comparatively large, with short antennae and short legs. When mounted 1302–1442 (1373)μ long, 322–350 (336)μ wide at mesothorax and 532–980 (644)μ wing expanse.

Body setae : Antennae with numerous fleshy and a few hair-like setae, about 28μ long. Body and legs with much shorter hair-like setae only.

Head : Subtetrahedron ; subtriangular in dorsal view and rather rounded in front view ; *ventral preocular depression* absent in lateral view. Length from apex to postoccipital ridge 131–143 (137)μ ; from apex to neck 189–204 (195)μ ; width across the genae 223–244 (229)μ. *Midcranial ridge* cruciform. *Postoccipital ridge* laterally forked. *Preocular* and *postocular ridges* well separated ; *preoral ridge* slender. *Eyes : Dorsal simple eyes* slightly projecting beyond the outer margins of the head in dorsal view ; their corneae 18–21 (20)μ in diameter and separated by 134–165 (146)μ, i.e. 6·3–8·5 (7·0) times their corneae apart. *Ventral simple eyes* 18–21 (19)μ in diameter and 73–95 (82)μ apart. *Ocellus* vestigial and merely represented by a sclerotized spot, attached to the postocular ridge by means of a slender sclerotization. *Cranial apophysis* apically bifurcate. *Tentorial bridge* stout. *Mouth tubercle* large. *Dorsal head setae* 10–15 (12·5) on each side ; each gena usually with 3–6 and occasionally 8 (av.) 4·7) *genal setae. Ventral head setae :* Setae between the ventral eyes absent ; 2–4 (2·8) just anterior to the preocular ridges, forming on both sides a transverse irregular row ; 1–2 (1·5) on each side of the ventral arm of the midcranial ridge. The mouth tubercle with 1–2 (1·6) minute setae.

A small body of unknown homology (X) occurs dorsally on each side near the apex of the head.

Antennae : Rather moniliform ; 10-segmented ; 522–583 (549)μ long, i.e. shorter than half the body length, the ratio being 1 : 2·3–2·6 (2·5), and slightly shorter than the hind legs, the ratio 1 : 1·1–1·2 (1·13). *Scape* 46–52 (49)μ long and 55–61 (58)μ wide at base ; always with 4 h.s. *Pedicel* 61–67 (64)μ long and 43–46 (45)μ wide ; with 1–2 (1·1) f.s., 2–3 (2·4) h.s. and a *sensillum placodeum. Flagellum :* Segment III–IX 34–40μ wide and segment X 27–31 (29)μ wide. Segment III club-shaped and longest of all, the ratio its length to the length of segment X 1·7–2·1 (1·9) : 1, and its width to its length 1 : 2·2–2·5 (2·3). Segments IV to IX barrel-shaped, the ratio width to length of segment IX being 1 : 1·0–1·4 (1·2). Terminal segment pear-shaped. Apically knobbed sensory setae entirely absent on the antennae. The following table shows the lengths of the flagellar segments and the number of setae on each :

	III	IV	V	VI	VII	VIII	IX	X
length in μ	76–92	46–61	52–67	49–64	49–61	40–49	37–46	43–46
(av.)	(85)	(50)	(61)	(58)	(52)	(46)	(43)	(45)
f.s.	3–8	3–9	5–9	7–12	8–15	5–8	4–8	2–4
(av.)	(5·1)	(6·2)	(7·4)	(9·5)	(10·8)	(7·1)	(6·2)	(2·8)
h.s.	2–6	2–4	1–2	1–2	1–3	0–1	1–2	0–1
(av.)	(3·3)	(2·9)	(1·5)	(1·3)	(1·8)	(0·7)	(1·2)	(0·6)

Antennal bristles well-defined ; segments VIII and IX each with one ventral bristle. Terminal segment with one dorsal preapical bristle, two lateral ones at a greater distance from the apex and one or two apical small hair-like setae.

Thorax : 403–464 (433)μ long. The thoracic structures, ridges and plates similar to *G. spuria. Prosternum* and *prosternal ridge* 21–27 (24) and 82–95 (89)μ long respectively. *Prothoracic setae* on each side : *Medial pronotal setae* 0–3 and occasionally 5 (av. 1·4) ; *lateral*

pronotal and *antespiracular dorsal setae* usually absent but 1–2 setae occasionally occur on either or both sides (averages 0·5 and 0·4 respectively). *Antespiracular ventral* and *prosternal setae* absent.

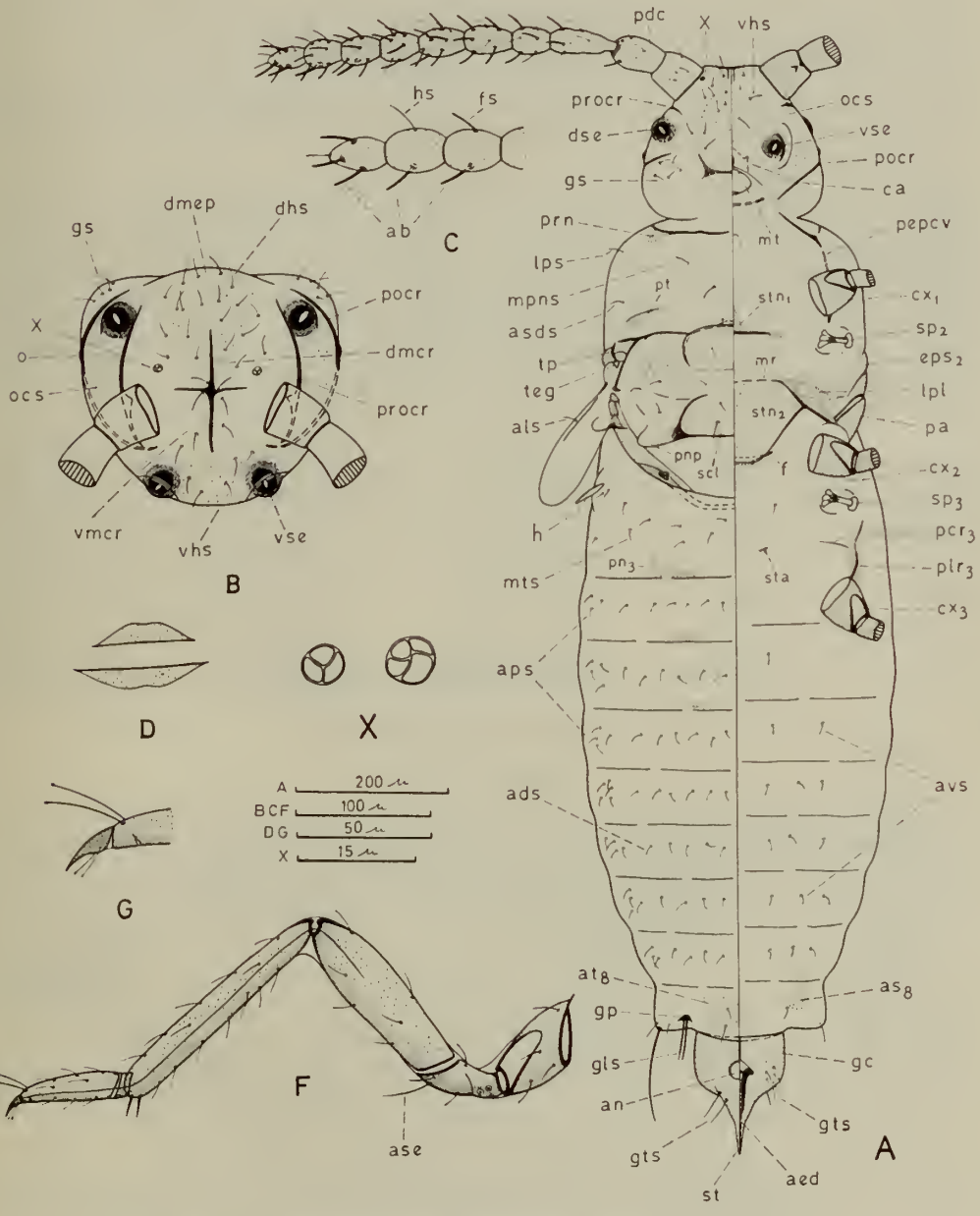


FIG. 50. *Gossyparia salicicola* Borchsenius, dorsal and ventral view.

Mesothorax : Prescutum 52–64 (58)μ long and 119–137 (131)μ wide, the ratio being 1 : 1·9–2·6 (2·3). *Scutum* 24–40 (32)μ long, i.e. the ratio lengths of prescutum to scutum 1·3–2·6 (1·8) : 1. *Scutellum* 40–58 (52)μ long and 150–165 (156)μ wide, the ratio 1 : 2·7–3·8 (3·0), and its length to the length of scutum 1·2–2·1 (1·6) : 1. *Basisternum* 101–122 (110)μ long and 168–183 (177)μ wide. *Mesothoracic spiracle* 18–21 (20)μ wide at opening, with a 49–55 (52)μ long supporting bar. *Mesothoracic setae* on each side : *Prescutal seta* 0–1 (0·3) ; *scutal setae* 2–6 (3·3) ; *scutellar setae* 1–3 (1·6). *Tegular setae* 0–1 (0·3). *Postmesostigmatal* and *basisternal setae* absent. *Metathoracic setae* on each side : *Metatergal setae* 6–14 (8·6) ; one *anterior metasternal seta* always present ; *metapleural* and *posterior metasternal setae* absent.

Wings : Greatly reduced ; 112–336 (168)μ long and 42–98 (56)μ wide ; *axillary sclerites* small ; *additional sclerites* and *alar lobe* absent ; *alar seta* 0–1 (0·6). *Hamulohalterae* atrophied, 27–49 (37)μ long and 12–15 (14)μ wide.

Legs : Short and stout ; the fore and the middle legs subequal in length and the hind legs longest ; the ratio length of the latter to the total length of body 1 : 2·1–2·3 (2·2). *Coxa* and *trochanter* about 64 and 40μ wide respectively ; the latter with a differentiated long *apical seta*. *Femur* about 49μ wide ; that of the middle leg shortest and those of the fore and hind legs subequal ; the ratio width to length of the hind femur 1 : 3·3–3·5 (3·4). *Tibia* about 31μ wide ; with 2 apical spurs ; in fore leg the ratio lengths of femur to tibia 1 : 1·17–1·24 (1·2). *Tarsus* about 24μ wide ; *tarsal digitules* apically knobbed, about 37μ long. *Ungual digitules* also apically knobbed. The following table shows the lengths of the leg segments (in microns) and the number of setae on each :

		Fore leg	Middle leg	Hind leg
Coxa	length	49–55 (52)	49–55 (52)	52–58 (55)
	h.s.	5–9 (7·4)	5–10 (8·2)	6–11 (8·5)
Trochanter	length	64–67 (66)	64–70 (67)	67–73 (70)
	h.s.	3–4 (3·5)	3–4 (3·4)	3–5 (3·9)
Femur	length	159–168 (165)	153–159 (156)	162–171 (168)
	h.s.	8–15 (12·1)	6–12 (9·5)	7–13 (11·2)
Tibia	length	189–204 (198)	192–207 (201)	204–223 (217)
	h.s.	15–19 (16·8)	13–19 (17·1)	13–20 (17·6)

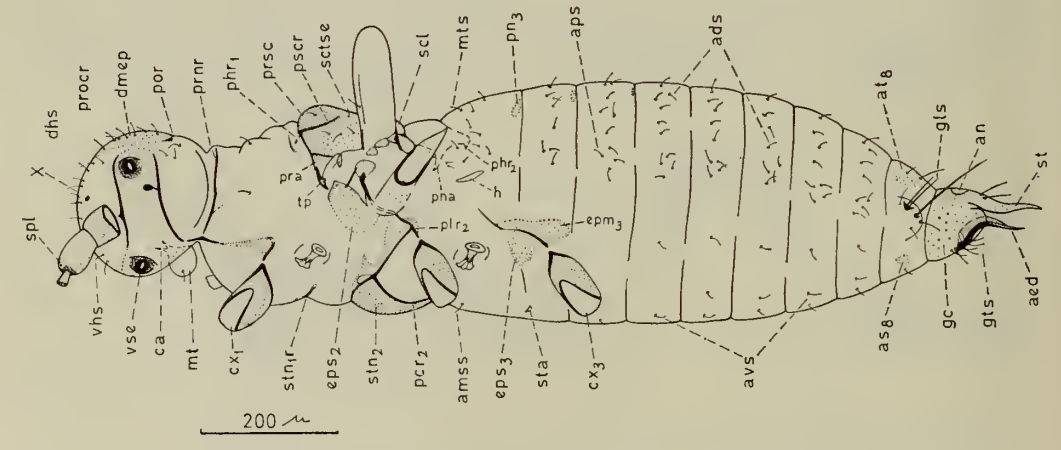


FIG. 51. *Gossyparia salicicola* Borchsenius, lateral view.

Tarsus	length	76–82 (79)	79–89 (86)	85–92 (89)
	h.s.	7–10 (8·2)	7–11 (9·1)	8–12 (9·9)
Claw	length	18–24 (21)	18–24 (21)	18–24 (21)
Total length of leg		558–595 (580)	558–595 (583)	592–634 (619)

Abdomen : 555–684 (623)μ long and 388–418 (410)μ wide. *Abdominal setae* on each side : *Dorsal setae* 4–9 on segments I and II, 4–7 on segments III and IV, 3–6 on segments V to VII, and 2 on segment VIII, including one slightly longer seta. *Pleural setae* 3–4 on segment I, 4–5 on segments II to VI, and 3–4 on segments VII and VIII, including one very long seta on the latter segment (107–137, av. 116μ). *Ventral setae* 1–2 on segment II, usually 3 on segments III to VII (sometimes 2 on segments III and IV, or 4 on segments IV and VII), and 1 on segment VIII.

Glandular pouches very small ; *setae of glandular pouch* only include a pair of comparatively short *tail setae*, 40–82 (64)μ long, the ratio their length to the total length of body being 1 : 17·1–34·9 (20·8). *Genital segment* typical of *G. spuria ; genital capsule* 146–171 (162)μ long and 113–122 (119)μ wide, the ratio being 1·3–1·5 (1·4) : 1, and the ratio its length to the total body length 1 : 7·8–9·8 (8·5). *Anal opening* 18–24 (22)μ in diameter. *Setae of genital segment* on each side : *Dorsally* two relatively long setae present near the base of the *style ; ventrally* 7–9 (7·8) smaller setae occur on the genital capsule.

Material : 10 specimens examined, collected by G. Matesova on *Salix* sp., in Alma Ata, Kazakhstan, U.S.S.R., 2.iv.1951.

Remarks : This species, although very closely related to the brachypterous males of *G. spuria*, can be distinguished mainly by the absence of the capitate sensory setae on the antennal segments ; other minor differences are the acquisition of more numerous abdominal setae and longer anal lobe seta.

PSEUDOCHERMES Nitsche, 1895

Pseudochermes fraxini (Kalt.)

(Text-fig. 52)

The apterous forms only known ; these are degenerate, and appear like the nymphal forms. The males dorso-ventrally flattened, moderately robust and spindle-shaped, i.e. the body broadest at mesothorax and gradually becoming narrower posteriorly ; the body ridges and sclerites absent or greatly reduced. A comparatively very small species, with very short antennae and legs ; mounted specimens 518–658 (602)μ long and 196–238 (210)μ wide at mesothorax.

Body setae : Antennae with very few fleshy and hair-like setae, 9–12μ long ; the body with sparse, slightly smaller hair-like setae only.

Head : Intimately fused with thorax ; head ridges entirely absent. *Eyes* represented by weakly sclerotized lateral spots, 89–95 (92)μ apart. *Cranial apophysis* vestigial, apically bifurcate. *Mouth opening* situated on a small, double-bulging *mouth tubercle* posteriorly. *Dorsal head setae* 3–4 (3·8) and *ventral head setae* 2–3 (2·8) on each side of the median line.

Antennae : Neither filiform nor moniliform, with segment VI distinctly widest of all flagellar segments ; normally 8-segmented, but sometimes fusion between adjacent segments occurs ; 146–174 (162)μ long, i.e. much shorter than half the body length, the ratio 1 : 3·5–3·9 (3·7), and slightly shorter than the hind legs, the ratio 1 : 1·1–1·2 (1·17). *Scape* 18–24 (20)μ long

and 24–31 (28)μ wide ; with 2–3 (2·4) h.s. *Pedicel* 18–27 (21)μ long and 21–24 (23)μ wide ; with 1–2 (1·6) h.s. *Flagellum :* Segment III club-shaped, with a very narrow stalk ; the ratio its length to the length of segment VIII being 1·2–1·8 (1·5) : 1, and the ratio width to length of

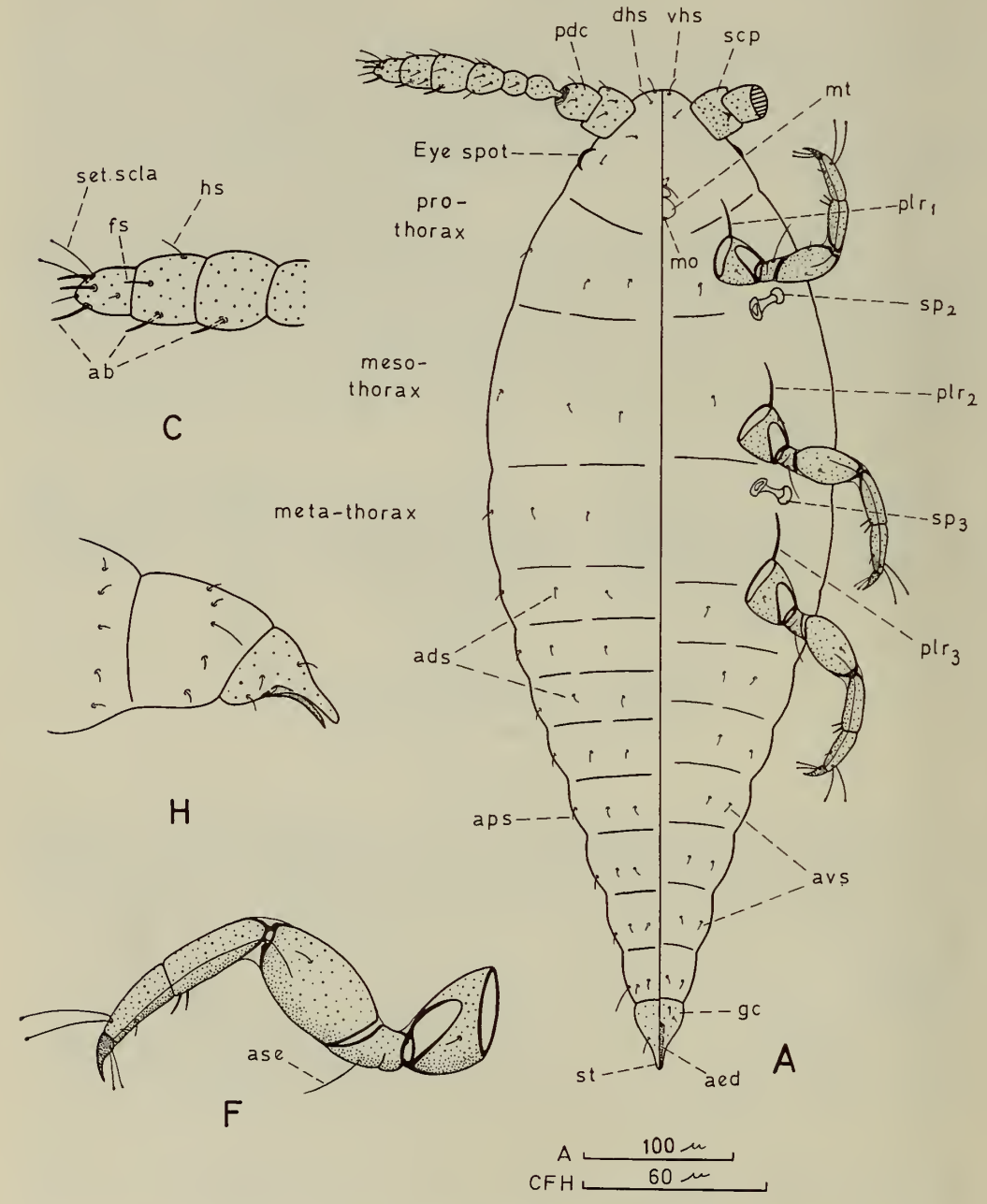


FIG. 52. *Pseucochermes fraxini* (Kalt.), apterous form, dorsal and ventral view.

segments III and VII 1 : 1·2–1·8 (1·4) and 1–1·2 (1·1) : 1, respectively. Segments V and VI becoming progressively wider, and segments VII and VIII decreasing in width.

The lengths, widths of the flagellar segments and the number of setae on each are given in the following table :

	III	IV	V	VI	VII	VIII
length in μ	21–27	15–21	18–24	18–21	18	15–18
(av.)	(25)	(17)	(20)	(19)	(18)	(17)
width in μ	15–18	15–18	18–24	21–24	18–21	15–18
(av.)	(17)	(17)	(21)	(23)	(20)	(16)
f.s.	0	0	1	1–2	1–2	0
(av.)	0	0	(1)	(1·2)	(1·2)	0
h.s.	0–1	0–1	1–2	0–1	1–2	0–1
(av.)	(0·2)	(0·4)	(1·8)	(0·2)	(1·8)	(0·4)

Antennal bristles well defined ; segments VI and VII each with one ventral bristle. Terminal segment with 3 preapical bristles, a pair of capitate *subapical sensory setae* and one apical hair-like seta.

Thorax : The thoracic ridges and sclerites greatly degenerate. *Pleural ridges* of thorax short and rudimentary. *Spiracles* 9–12 (10)μ wide at opening, with 24–31 (27)μ long supporting bars. *Prothoracic* and *mesothoracic setae :* 2–3 (2·5) dorsal, one pleural, and one ventral setae present on each side of the median line. *Metathoracic setae :* 2–3 (2·7) dorsal, and one pleural setae occur on each side.

Legs : Comparatively short and very stout , the fore and the middle legs subequal in length, the hind leg slightly longer ; the ratio length of the hind leg to the total length of body 1 : 2·9–3·4 (3·2). *Coxa* and *trochanter* about 31 and 18μ wide respectively ; the latter with a differentiated long *apical seta*. *Femur* about 28μ wide ; that of the middle leg shortest and those of the fore and hind legs subequal ; the ratio width to length of the hind femur being 1 : 1·8–2·0 (1·9). *Tibia* about 18μ wide ; with 2 small spines ; in fore leg the ratio lengths of femur to tibia 1·4–1·5 (1·45) : 1. *Tarsus* about 18μ wide ; *tarsal digitules* apically knobbed, about 24μ long. *Claw* broad at base and abruptly tapering apically ; *ungual digitules* also apically knobbed. The lengths of the leg segments (in microns) and the number of setae on each are given in the following table :

		Fore leg	Middle leg	Hind leg
Coxa	length	24–31 (28)	24–31 (28)	27–31 (29)
	h.s.	2–3 (2·2)	2–3 (2·2)	2–3 (2·6)
Trochanter	length	18–21 (19)	18–21 (19)	21–24 (22)
	h.s.	(1)	(1)	(1)
Femur	length	49–55 (52)	49–55 (53)	49–55 (53)
	h.s.	1–2 (1·2)	1–2 (1·2)	1–2 (1·4)
Tibia	length	34–37 (35)	34–37 (35)	37–40 (39)
	h.s.	0	0	0
Tarsus	length	27–31 (29)	27–31 (29)	27–31 (30)
	h.s.	2–3 (2·4)	2–3 (2·2)	2–3 (2·2)
Claw	length	15–18 (16)	15–18 (16)	15–18 (16)
Total length of leg		168–183 (180)	171–183 (180)	177–195 (189)

Abdomen : Abdominal tergites and sternites absent. *Abdominal setae* on each side : *Dorsal setae* usually 2 and sometimes only 1 on segments I to VIII. *Pleural setae* always 1. *Ventral setae* 1 on segment II, 2 on segments III to VI, and 1–2 on segments VII and VIII.

Ostioles as well as *glandular pouches* entirely absent. *Genital segment : Genital capsule*

comparatively very small, 37–40 (39)μ long and 31–34 (32)μ wide, i.e. the ratio 1·2–1·3 (1·23) : 1, and its length to the total length of body 1 : 14·1–17·0 (15·4) ; *style* rather straight in lateral view, apically rounded. *Aedeagus* ventrally sclerotized and tapering apically. *Setae of genital segment :* The genital capsule always with one *dorsal* and two *ventral setae* on each side.

Material : 10 specimens examined, collected by K. Boratynski, on ash trees (*Fraxinus excelsior*), in the gardens of Buckingham Palace, London, 20.x.1963.

Remarks : The mating behaviour of this species was observed in the laboratory. The females, covered with copious waxy secretion, remain fixed usually deep in the crevices of the bark with their heads at the bottom of the crevices and their abdomina directed towards the surface. The male wandering about, somehow is capable of locating the position of the posterior end of the female ready for copulation, pushes its abdomen through the waxy covering and copulation takes place. These observations may suggest that the females remain under their waxy covering until the eggs are fertilized, then migrate to another position to start laying the eggs ; those unmated appear to remain in their positions until they perish.

KEYS

The following keys are intended to separate the studied species and their supra-specific categories. Since the significance of some characters is still uncertain, the keys will include as many characters as possible, even more than actually necessary for this purpose. It should be noticed that the numbers of setae and disc pores given in these keys are always on one side only.

Macropterous Males

Key to Pseudococcidae and Eriococcidae

Postoccipital ridge weak, slender, U- or V-shaped. Tentorial bridge comparatively slender. Flagellar segments of the antennae, including the terminal, cylindrical and elongated. Dorsal margin of the proepisternum ridge-like. Scutellum pentagonal in dorsal view ; its length half its width or more ; scutellar ridge absent. Anterior and posterior postalar ridges well separated. Mesopleural ridge interrupted above the coxal articulation. Basal part of the trochanter conspicuously longer than the distal. Claw gradually tapering apically ; ungual digitules not knobbed. Dorsal setae of abdominal segment VIII subequal in length to other abdominal setae ; setae of the glandular pouch include a pair of long tail setae and one or more much shorter ones. Basal part of the penial sheath short, not fused with the 9th tergite + 10th segment. Anal opening minute. Aedeagus arising just behind the basal ridges of the penial sheath. Dorsal setae of the genital segment similar to other abdominal setae, always 3 or more. Derm pores present (except in *Nairobia bifrons*). The puparia fluffy and loosely felted Pseudococcidae (p. 93)

Postoccipital ridge strongly developed and laterally forked. Tentorial bridge comparatively stout. Terminal flagellar segments of the antennae barrel-shaped, often as long as wide ; the terminal segement distinctly pear-shaped. Proepisternum without any ridge-like sclerotization. Scutellum transverse, rectangular in dorsal view ; its length less than half its width ; with a well developed scutellar ridge on each

side. Anterior and posterior postalar ridges anteriorly joined. Mesopleural ridge continuous above the coxal articulation. Basal part of the trochanter shorter than the distal. Claw broad at base, abruptly tapering apically ; ungual digitules apically knobbed. One of the dorsal setae on each side of abdominal segment VIII much longer than the others ; setae of the glandular pouch include one pair of tail setae only. Basal part of the penial sheath long, fused with the 9th tergite + 10th segment and forming together a compact genital capsule. Anal opening large. Aedeagus arising at a comparatively large distance from the basal ring of the genital capsule. Dorsal setae of the genital segment considerably longer than other abdominal setae, always 2. Derm pores absent. The puparia compact, closely felted and rather flattened . . . . . ERIOCOCCIDAE (p. 167)

Pseudococcidae

KEY TO GROUPS OF GENERA

1 Dorsal, lateral and ventral arms of the midcranial ridge joined, forming together a cruciform structure. Pre- and postocular ridges widely separated; interocular ridge absent. Anterior tentorial arms each apparently individually fused with the cranial apophysis. Penultimate antennal segment more than 3·7 times as long as wide. Prescutum triangular in dorsal view. Scutum without a median longitudinal narrow membranous area, and much shorter than either the prescutum or the scutellum. Precoxal ridge of the metathorax weakly developed ; metapleural wing process absent. Tarsal digitules absent. Setae of the glandular pouch include two long tail setae and a short one, subequal in length to the other abdominal setae ; the tail setae comparatively short, the body being 5 times as long, or longer . . 2

– Dorsal arm of the midcranial ridge distinctly detached from the Y- or T-shaped ridge formed by the lateral and the ventral arms. Pre- and postocular ridges joined together by means of a well developed interocular ridge. Anterior tentorial arms anteriorly fused with each other before joining the cranial apophysis. Penultimate antennal segment less than 3·7 times as long as wide. Prescutum transverse, rectangular in dorsal view. Scutum with a distinct median longitudinal narrow membranous area, and longer than either the prescutum or the scutellum. Precoxal ridge of the metathorax well developed ; with a small metapleural wing process. Tarsal digitules present. Setae of the glandular pouch include a pair of long tail setae and one or more setae conspicuously longer than other abdominal setae ; the tail setae comparatively long, the body being less than 5 times as long 3

2 (1) Disc pores absent. Lateral ocelli vestigial. Third and terminal antennal segments subequal in length (third not more than 1·1 times as long as terminal) ; the length of segment III less than 5 times its width. Antennal setae subequal in length to the body setae ; capitate, apically knobbed sensory setae present on segments III to X. Proepisternum with only the dorsal margin ridge-like. Prescutal ridges well separated postero-medially. Postmesostigmatal setae, alar setae and metapostnotal ridge absent. Fore legs shortest. Ostioles absent. Dorsal setae of abdominal segment VIII absent. Glandular pouches and their setae only on abdominal segment VIII ; the tail setae relatively short, the body being 8 or more times as long. Basal ridges of the penial sheath medially continuous

NAIROBIA group (p. 163)
[Only one species, *N. bifrons*]

Disc pores present. Lateral ocelli well developed. Third antennal segment longer than the terminal (1·4 or more times as long) ; the length of segment III more than 5 times its width. Antennal setae about twice as long as the body setae ; capitate, apically knobbed sensory setae entirely absent. Proepisternum with dorsal and ventral margins ridge-like. Prescutal ridges continuous postero-medially. Postmesostigmatal setae, alar setae and metapostnotal ridge present. Middle legs shortest. Ostioles present. Dorsal setae of abdominal segment VIII present. Glandular pouches and their setae on abdominal segments VII and VIII ; the tail setae of segment VIII rather long, the body being less than 8 times as long. Basal ridges of the penial sheath medially separated . . . ***CEROPUTO*** group (p. 155)

3 (1) Antennae comparatively long (the body 1·5 or less times as long) ; longer than the hind legs. Few capitate, apically knobbed sensory setae present on antennal segments III to X. Antespiracular dorsal setae and pores absent. Basalare weak and slender. Abdominal disc pores only present on segment I. Setae of the glandular pouch include a pair of long tail setae, two setae of medium, unequal lengths and a short one . ***OCTOCOCCUS*** group (p. 151)
[Only one species, *O. africanus*.]

– Antenna comparatively short (the body 1·6 or more times as long) ; shorter than the hind leg, or both subequal in length. Capitate, apically knobbed, sensory setae only present on terminal antennal segment. Antespiracular dorsal setae and pores present. Basalare comparatively stout. Abdominal disc pores present on all abdominal segments. Setae of the glandular pouch include a pair of long tail setae and one of medium length or short . . 4

4 (3) The head and the body dorso-ventrally flattened ; ventral preocular depression entirely absent. Postoccipital ridge V-shaped. Postocular ridge dorsally reduced. Prosternal ridge absent. Two antespiracular ventral setae always present. Prescutal suture absent. The marginal ridge of the basisternum anteriorly absent. Furca comparatively small. Hind legs short, the body more than 2·2 times as long ***SACCHARICOCCUS*** group (p. 143)
[Only one species, *S. sacchari*.]

– The body cylindrical ; ventral preocular depression present. Postoccipital ridge U-shaped. Postocular ridge well developed. Prosternal ridge distinct. Only one antespiracular ventral seta present. Prescutal suture well-defined. The marginal ridge of the basisternum well developed. Furca comparatively large. Hind legs long, the body less than 2·2 times as long 5

5 (4) Fleshy setae present on the body itself, giving the males a distinctive hairy appearance. Ventral ocular setae present. Genal setae more than 7, and prosternal setae more than 3 . . . . ***PSEUDOCOCCUS*** group (p. 131)

– Fleshy setae absent on the body itself. Ventral ocular setae absent. Genal setae less than 7, and prosternal setae less than 3 ***PLANOCOCCUS*** group (p. 93)

Key to *CEROPUTO* Group of Genera

Fleshy setae present on antennae and legs. Dorsal arm of midcranial ridge distinct. Setae between the ventral simple eyes absent. Terminal antennal segment with 3 preapical large bristles and 2 smaller ones ; the preapical bristles about twice as long as those of the two penultimate segments. Prosternum represented by a pair of separate, small plates connected by the prosternal ridge. Prescutum 4 times or more as long as scutum. Scutellum laterally supported by a distinct additional ridge. Lateropleurite with an oval membranous area. Postmesostigmatal pores

absent. Ostioles well developed. Aedeagus comparatively slender. More than 3 dorsal setae of the genital segment present . . . ***CENTROCOCCUS*** (p. 159)
[Only one species, *C. insolitus*.]

Fleshy setae entirely absent. Dorsal arm of the midcranial ridge only marked by weak sclerotization. Setae between the ventral simple eyes present. Terminal antennal segment with only three well defined preapical bristles, subequal in length to those of the two penultimate segments. Prosternum triangular. Prescutum less than 3·5 times as long as scutum. Scutellum without lateral edges. Lateropleurite without membranous areas. Postmesostigmatal pores present at least on one side. Ostioles ill-defined. Aedeagus rather stout. 3 dorsal setae of the genital segment always present . . . . . ***CEROPUTO*** (p. 155)
[Only one species, *C. pilosellae*.]

Key to *PSEUDOCOCCUS* Group of Genera

Dorsal arm of the midcranial ridge disappearing before meeting postoccipital ridge ; the latter anteriorly confluent with the preocular ridge. Dorsal ocular setae present. One dorsal head pore usually present. Tegular setae less than 4. Abdominal disc pores occur laterally and also dorsally and ventrally . ***DYSMICOCCUS*** (p. 139)
[One species only, *D. alazon*.]

Dorsal arm of the midcranial ridge posteriorly meeting the postoccipital ridge ; the latter not reaching the preocular ridges anteriorly. Dorsal ocular setae absent. More than one dorsal head pore present. Tegular setae more than 4. Abdominal disc pores present only laterally . . . . . ***PSEUDOCOCCUS*** (p. 131)

Key to *PLANOCOCCUS* Group of Genera

1 Style of the genital segment more or less straight and apically rounded in lateral view 2

– Style curving upwards and apically pointed in lateral view . . . 3

2 (1) Dorsal arm of midcranial ridge absent. Head disc pores absent. Antennal setae about twice as long as the body setae ; the dorsal bristle of the terminal antennal segment slightly shorter than the lateral bristles. Post-tergital setae present. Prosternal and postmesostigmatal pores absent ; metatergal pores present. Abdominal disc pores only present laterally. The body 10 times or more as long as the penial sheath ; the style comparatively broad. Aedeagus rather short, curving dorso-posteriorly ***FERRISIANA*** (p. 122)
[Only one species, *F. virgata*.]

– Dorsal arm of midcranial ridge distinct. Head disc pores present. Antennal setae about as long as the body setae ; the dorsal bristle of the terminal antennal segment much shorter than the lateral ones (about half as long). Post-tergital setae absent. Prosternal and postmesostigmatal pores present ; metatergal pores missing. Abdominal pores present laterally and also dorsally and ventrally. The body 8·5 times or less as long as the penial sheath ; the style comparatively narrow. Aedeagus rather long, anteriorly curving from its basal rod and reaching the cavity of abdominal segment VII . . . . . ***MACONELLICOCCUS*** (p. 118)
[Only one species, *M. hirsutus*.]

3 (1) Dorsal arm of midcranial ridge posteriorly meeting the postoccipital ridge. One dorsal head pore only usually present. Antennal scape almost always with 4 hair-like setae. Postmesostigmatal pores present, at least on one side. Ostioles ill-defined or absent. 4

– Dorsal arm of midcranial ridge fading out well before meeting the postoccipital ridge. Two or more dorsal head pores present. Antennal scape with more than 4 hair-like setae. Postmesostigmatal pores absent. Ostioles well developed 5

4 (3) Lateral arms of midcranial ridge represented only by weak sclerotization. Preocular ridge with a well-marked ventral rudiment below the articular process. Genal setae more than 3. Prosternum long and narrow. Postmesostigmatal setae present in the median and the sublateral areas. Hamulohaltera 1·9 times or more as long as its apical seta. Femur of fore-leg shortest. All pleural setae of abdominal segment VIII subequal in length . . . . . ***TRIONYMUS*** (p. 126)
[Only one species, *T. newsteadi*.]

– Lateral arms of midcranial ridge well developed. Ventral rudiment of the preocular ridge absent. Genal setae 3 or less. Prosternum triangular. Postmesostigmatal setae only present sublaterally. Hamulohaltera 1·6 or less times as long as its apical seta. Femur of middle leg shortest. Pleural setae of abdominal segment VIII include one slightly longer seta ***NIPAECOCCUS*** (p. 110)

5 (3) Ventral rudiment of the preocular ridge entirely absent. Third antennal segment 3·3 times or less as long as wide. The three large bristles of the terminal antennal segment of subequal lengths. In fore leg, the tibia shorter than the femur . . . . . ***PLANOCOCCOIDES*** (p. 106)
[Only one species, *P. ireneus*.]

– Ventral rudiment of the preocular ridge distinct. Third antennal segment usually more than 3·3 times as long as wide. The dorsal bristle of the terminal antennal segment slightly shorter than the two lateral ones. In fore leg, the tibia longer than the femur . . . ***PLANOCOCCUS*** (p. 93)

PSEUDOCOCCUS

Key to Species

1 Penial sheath distinctly triangular in dorsal view, with the style gradually tapering apically 2

– Penial sheath subtriangular in dorsal view, the style being rather broad or truncate posteriorly 3

2 (1) Antennae short, the body being more than twice as long. Only one antespiracular ventral seta present. One postmesostigmatal pore always present medially. Posterior metasternal seta less than 3. Ventral setae of abdominal segment VIII absent. Abdominal pores only present laterally. Genital segment long, the body being less than 7 times as long. Aedeagus long, anteriorly reaching the cavity of abdominal segment VII, and evenly tapering posteriorly . . . . . ***P. citriculus***

– Antennae moderately long, the body being less than twice as long. More than one antespiracular ventral seta present. Posterior metasternal setae more than 5. Ventral setae of abdominal segment VIII at least 4. Abdominal pores present laterally and dorsally. The genital segment rather short, the body being more than 8 times as long. Aedeagus not reaching the cavity of abdominal segment VII, with the distal part broadened in lateral view ***P. fragilis***

3 (1) Post-tergital setae 9 or more. Anterior metasternal setae more than 10. Metaspiracular and anterior metasternal pores absent. Penial sheath broad, its length less than 1·5 times its width ; process of the penial sheath well pronounced ; style apically truncate in dorsal view . . ***P. adonidum***

– Post-tergital setae 6 or less. Anterior metasternal setae less than 9. Metaspiracular and anterior metasternal pores present. Penial sheath moderately narrow, its length more than 1·6 times its width ; process of the penial sheath absent ; apex of style broadly rounded in dorsal view . . . 4

4 (3) Postmesostigmatal setae only present sublaterally. Ventral setae of abdominal segment VIII absent . . . . . ***P. obscurus*** (p. 131)

– Postmesostigmatal setae present sublaterally and also medially. Ventral setae of abdominal segment VIII usually present ***P. maritimus*** 'Type A' (p. 135)

NIPAECOCCUS

Key to Species

Relatively small, 840–980 (896) μ long. Fleshy setae present on the legs. The dorsal simple eyes smaller than the ventral ; the dorsal eyes more than 4 times their diameter apart. With less than 3 genal setae. Antennae as long as, or slightly longer than the hind legs. The antennal setae about twice as long as the body setae. Terminal antennal segment with 3 bristles only. Anterior apex of prosternum forming a weakly sclerotized ring. With 7 or more medial pronotal pores. Width of prescutum less than 1·4 times its length. Scutal setae less than 4. Metaspiracular pores and ostioles absent. Abdominal pores present only laterally ***N. nipae*** (p. 114)

Moderately large, 1148–1358 (1246) μ long. Fleshy setae absent on the legs. The dorsal simple eyes larger than the ventral ; the dorsal eyes less than 4 times their diameter apart. Genal setae almost always 3. Antennae shorter than the hind legs. The antennal setae about as long as the body setae. Terminal antennal segment with 3 large and 2 smaller bristles. Anterior apex of prosternum without a sclerotized ring. With less than 5 medial pronotal pores. Width of prescutum 1·4 or more times its length. Scutal setae more than 5. Metaspiracular pores and ostioles present. Abdominal pores present laterally and also ventrally on one or more segments . . . . . ***N. vastator*** (p. 110)

PLANOCOCCUS

Key to Species

1 Postoccipital ridge anteriorly confluent with the preocular ridges. Dorsal head pores 4 or more. Prosternal ridge double-barred. Post-tergital pores present. Metatergal setae absent . . . . . ***P. dioscoreae*** (p. 102)

– Postoccipital ridge not reaching the preocular ridges anteriorly. Dorsal head pores less than 4. Prosternal ridge singular. Post-tergital pores absent. Metatergal setae present 2

2 (1) Antennal segment III longer than the terminal. Middle femur slightly shorter than the front. A ventral pore present at least on one side of abdominal segment VII. Aedeagus comparatively broad . . . ***P. kenyae*** (p. 98)

– Antennal segment III shorter, or as long as the terminal. Middle femur slightly longer than the front. Ventral abdominal pores entirely absent. Aedeagus comparatively narrow . . . . . ***P. citri*** (p. 93)

ERIOCOCCIDAE

Key to Genera

1 Fleshy setae present on the legs. Prosternal setae present. Hamulohaltera subequal in length to its apically hooked seta. Trochanter without long, differentiated apical setae . . . . . ***ERIOCOCCUS*** (p. 167)

– Fleshy setae absent on the legs. Prosternal setae absent. Hamulohaltera, if present, 1·6 or more times as long as its apically hooked seta. Trochanter with a long apical seta 2

2 (1) Lateral arms of the midcranial ridge short and weak. Ocelli vestigial. Genal setae 3 or less. Unidentified disc-like structures absent on the head. With a small mouth tubercle. The body not more than twice as long as the antennae. Antespiracular ventral setae present. Scutellum slightly longer than scutum. Hamulohalterae and suspensorial sclerites entirely absent. The body less than twice as long as the hind leg. Pleural setae of abdominal segment VIII include one seta slightly longer than the others. Style rather straight in lateral view . . . . . ***OVATICOCCUS*** (p. 179)
[Only one species, *O. agavium*.]

– Lateral arms of the midcranial ridge well developed. Ocelli large. Genal setae 4 or more. One or more disc-like structures present dorsally on each side of the midcranial ridge. Mouth tubercle absent. The body more than twice as long as the antennae. Antespiracular ventral setae absent. Scutellum shorter than scutum. Hamulohalterae and suspensorial sclerites well developed. The body more than twice as long as the hind leg. Pleural setae of abdominal segment VIII include one seta about twice as long as others. Style sinuated in lateral view . . . . ***GOSSYPARIA*** (p. 182)
[Only one species, *G. spuria*.]

ERIOCOCCUS

Key to Species

1 Ventral part of the preocular ridge reduced. Cranial apophysis truncate. With 12 or more dorsal head setae ; setae of the ocular sclerites and the setae between the ventral eyes present. Genal setae more than 7. Antennae 9-segmented ; 3rd segment 2·5 or more times as long as the terminal ; capitate sensory setae only present on the terminal segment. Lateropleurite with a distinct membranous area. Prescutal setae 6 or more ; mesopisternal, postmesostigmatal and basisternal setae present. Metatergal setae 4 or more ; metapleural and postmetastigmatal setae present. Tergite of abdominal segment VIII anteriorly bounded by differentiated heavy sclerotization. The body 7·7 or more times as long as the tail setae of the glandular pouches . . . . . ***E. buxi*** (p. 175)

– Preocular ridge well developed. Cranial apophysis bifurcate. With less than 12 dorsal head setae ; setae of the ocular sclerite and the setae between the ventral eyes absent. Genal setae less than 7. Antennae 10-segmented ; 3rd segment less than 1·8 times as long as the terminal ; capitate sensory setae present at least on the three terminal segments. Lateropleurite without membranous areas. Prescutal setae 2 or less ; mesepisternal, postmesostigmatal and basisternal setae absent. Metatergal setae 3 or less ; metapleural and postmetastigmatal setae absent. Tergite of abdominal segment VIII without anterior heavy sclerotization. The body usually less than 7·7 times as long as the tail setae of the glandular pouches . . 2

2 (1) Comparatively small species, less than 1000 μ long. Dorsal and ventral simple eyes subequal in diameter ; the former separated by 4·5 or more times their diameter. Structures of obscure homology absent on the head. Third antennal segment less than 3·4 times long as wide ; terminal segment only with 3 antennal bristles. Scutellum slightly shorter than scutum. With a minute lateropleurital seta. Total length of the body usually more than 2·1 times the length of the hind legs. Sternites of abdominal segment VIII laterally bounded with longitudinal heavy sclerotization. Genital capsule 2·6 or more times long as wide, and the body less than 7·9 times its length ; style rather straight in lateral view . . . ***E. orariensis*** (p. 171)

– Comparatively large species, more than 1000 μ long. The dorsal eyes larger than the ventral, and separated by less than 3·5 times their diameter. A body of unknown homology present on each side of the midcranial ridge. Third antennal segment 3·4 or more times long as wide ; terminal segment with 3 large and 2 smaller antennal bristles. Scutellum longer than scutum. Lateropleurital setae absent. Total body length less than 2·1 times the length of the hind legs. Sternites of abdominal segment VIII without differentiated heavy sclerotization. Genital capsule twice or less times as long as wide, and the body 7·9 or more times its length ; style sinuating in lateral view . . . . . ***E. araucariae*** (p. 167)

Brachypterous Males

GOSSYPARIA

Key to Species

Capitate sensory setae entirely absent. Usually with 7 or more metatergal setae. The fore and the middle legs subequal in length . . . . ***G. salicicola*** (p. 190)

Capitate sensory setae present on the antennae. Usually with less than 7 metatergal setae. The middle legs shortest . . . . . ***G. spuria*** (p. 186)

Apterous Males

Only two species whose apterous male forms were studied, *Saccharicoccus sacchari* and *Pseudochermes fraxini*. While the macropterous males of the former were also studied, only the apterous form of the latter was available which is obviously degenerate. The comparison therefore would not serve any useful purpose.

LETTERING USED IN TEXT-FIGURES

(A) General dorso-ventral view of the body.
(B) Front view of the head.
(B_1) Lateral view of the head.
(C) Terminal 3 antennal segments showing the antennal bristles, few sensory setae, one fleshy and one hair-like setae.
(D) Mesoprephragma (anterior view) and mesopostphragma (posterior view).
(E) Disc pores.
(F) Hind leg.
(G) Hind claw and distal end of tarsus showing the tarsal digitules (if present) and the claw digitules.
(H) Lateral view of the genital segment.
(H_1) Ventral view of the genital segment.
(I) Tentorium and cranial apophysis.
(X) Structures of obscure homology.

LIST OF ABBREVIATIONS

a	finger-like apodeme
ab	antennal bristles
addr	additional ridge
adp	abdominal dorsal pores
ads	abdominal dorsal setae
aed	aedeagus
al	alar lobe
als	alar setae
amsp	anterior metasternal pores
amss	anterior metasternal setae
an	anus
anp	anterior notal wing process
ap	articular process
apar	anterior postalar ridge
app	abdominal pleural pores
aps	abdominal pleural setae
as	abdominal sternite
asc	additional sclerite
asdp	antespiracular dorsal pores
asds	antespiracular dorsal setae
ase	differentiated apical seta
asvs	antespiracular ventral setae
at	abdominal tergite
ata	anterior tentorial arms
avp	abdominal ventral pores
avs	abdominal ventral setae
ax_1	first axillary sclerite
ax_2	second axillary sclerite
ax_3	third axillary sclerite
axc	axillary cord
bas	basalare
bra	basal rod of aedeagus
brps	basal ridge of penial sheath
bs	sensilla basiconica
ca	cranial apophysis
ccx	costal complex of wing veins
cl	claw
cx	coxa
cam.s	campaniform sensillum
dhp	dorsal head pores
dhs	dorsal head setae
dmcr	dorsal arm of midcranial ridge
dmep	dorsomedial part of epicranium
dos	dorsal ocular setae
dse	dorsal simple eyes
epm_2	mesepimeron
epm_3	metepimeron
eps_2	mesepisternum
eps_2s	mesepisternal setae
eps_3	metepisternum
eps_3s	postmetastigmatal setae
f	furca
fem	femur
fp	furcal pit
fs	fleshy setae
g	gena
gc	genital capsule
gls	setae of glandular pouch
gp	glandular pouch
gs	genal setae
gts	setae of genital segment
h	hamulohaltera
hr	hamulohalteral ridge
hs	hair-like setae
iga	internal genital aperture
ior	interocular ridge
lmcr	lateral arm of midcranial ridge
lpl	lateropleurite
lpls	lateropleurital setae
lpp	lateral pronotal pores
lps	lateral pronotal setae
mcr	midcranial ridge
med	media
mo	mouth opening
mpnp	medial pronotal pores
mpns	medial pronotal setae
mps	metapleural setae
mr	marginal ridge
mt	mouth tubercle
mtp	metatergal pores
mts	metatergal setae
o	ocellus
ocs	ocular sclerite
ocse	setae of ocular sclerite
ost	ostiole
pa	postalare
pcr2	precoxal ridge of mesothorax
pcr3	precoxal ridge of metathorax
pdc	pedicel
pepcv	proepisternum + cervical sclerite

phr_1	mesoprephragma
phr_2	mesopostphragma
pla_1	propleural apophysis
pla_2	mesopleural apophysis
pla_3	vestigial metapleural apophysis
plr_1	propleural ridge
plr_2	mesopleural ridge
plr_3	metapleural ridge
pmp	postmesostigmatal pores
pms	postmesostigmatal setae
pmsp	posterior metasternal pores
pmss	posterior metasternal setae
pn_3	metapostnotal sclerite
pna	postnotal apophysis
pnp	posterior notal wing process
pn_3r	metapostnotal ridge
pocr	postocular ridge
por	postoccipital ridge
ppar	posterior postalar ridge
pr	projection of basal ridge
pra	prealare
prar	prealar ridge
prn	lateral pronotal sclerite
prnr	pronotal ridge
pro	process of penial sheath
procr	preocular ridge
pror	preoral ridge
pros	setal sensilla of process of penial sheath
prsc	prescutum
ps	penial sheath
pscr	prescutal ridge
pscs	prescutal suture
pscse	prescutal setae
pt	post-tergite
pta	posterior tentorial arm
ptdp	post-tergital pores
ptp	posterior tentorial pit
pts	post-tergital setae
pwp2	mesopleural wing process
pwp3	vestigial metapleural wing process
rad	radius
rd	posterior marginal fold of notum
sa	subalare
scl	scutellum
sclr	scutellar ridge
scls	scutellar setae
scp	scape
sct	scutum
scts	scutoscutellar suture
sctse	scutal setae
sens.	circular sensoria
ser	subepisternal ridge
set. ca	capitate sensory setae
set. scla	subapical sensory setae
sp2	mesothoracic spiracle
sp3	metathoracic spiracle
spl	sensillum placodeum
sp2p	mesospiracular pores
sp3p	metaspiracular pores
ss	suspensorial sclerite
st	style
sta	metasternal apophysis
stn_1	prosternum
stn_2	mesosternum (basisternum)
stn_1p	prosternal pores
stn_1r	prosternal ridge
stn_1s	prosternal setae
stn_2s	basisternal setae
sts	minute sensilla of style
tar	tarsus
tb	tentorial bridge
tdgt	tarsal digitule
teg	tegula
tegs	tegular setae
tib	tibia
tn	trochantin
tp	triangular plate
tr	trochanter
ts	tail setae
udgt	ungual digitules
vc	ventral cavity
vhp	ventral head pores
vhs	ventral head setae
vmcr	ventral arm of midcranial ridge
vos	ventral ocular setae
vprd	ventral preocular depression
vse	ventral simple eyes
x	structure of obscure homology

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